

DIAGNOSTIC AND THERAPEUTIC STUDIES ON EQUINE LAMENESS AT UNIVERSITY VETERINARY HOSPITAL

Thesis

**Submitted to the Guru Angad Dev Veterinary and Animal Sciences University
in partial fulfillment of the requirements for the degree of**

**MASTER OF VETERINARY SCIENCE
in
VETERINARY SURGERY AND RADIOLOGY
(Minor Subject: Veterinary Anatomy)**

By

**Kush Karan
(L-2019-V-100-M)**



**Department of Veterinary Surgery and Radiology
College of Veterinary Science**

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2021

CERTIFICATE I

This is to certify that the thesis entitled, “**Diagnostic and therapeutic studies on equine lameness at University Veterinary Hospital.**” submitted for the degree of **M.V.Sc.**, in the subject of **Veterinary Surgery and Radiology** (Minor subject: **Veterinary Anatomy**) of the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, is a bonafide research work carried out by **Kush Karan (L-2019-V-100-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

(Dr. Ashwani Kumar)
Major Advisor
Professor
Department of Veterinary Surgery
and Radiology
Guru Angad Dev Veterinary and
Animal Sciences University
Ludhiana – 141 004, Punjab, India

CERTIFICATE II

This is to certify that the thesis entitled, “**Diagnostic and therapeutic studies on equine lameness at University Veterinary Hospital.**” submitted by **Kush Karan (L-2019-V-100-M)** to Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, in partial fulfillment of the requirements for the degree of **M.V.Sc.** in the subject of **Veterinary Surgery and Radiology** (Minor subject: **Veterinary Anatomy**) has been approved by the Student’s Advisory Committee after an oral examination on the same, in collaboration with an external examiner.

(Dr. Ashwani Kumar)
Major Advisor

External Examiner
Dr. Ajay Kumar Gupta
Professor
Division of Veterinary Surgery & Radiology
F.V.Sc., & A.H.; SKUAST of Jammu,
R.S. Pura, Jammu -181 102

(Dr. Navdeep Singh)
Head of the Department

(Dr. Sanjeev Kumar Uppal)
Dean, Postgraduate Studies
Guru Angad Dev Veterinary
and Animal Sciences University
Ludhiana, Punjab

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Date:

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(Kush Karan)

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Name of the student & Admission No. : Kush Karan
(L-2019-V-100-M)

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Name and Designation of Major Advisor : Dr. Ashwani Kumar
Professor

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University, Ludhiana – 141 004 (India)

ABSTRACT

The one year prospective clinical study was done with the objectives to investigate the occurrence of equine lameness associated with bones, joints and soft tissues at University Veterinary Hospital and to evaluate the long term outcome of various causes of equine lameness. The hospital occurrence of lameness among equines was 49.26% (67/136). Marwari breed was most commonly presented (32.83%). Most of the lame equines were athletic, >5 years of age (50.75%) and had chronic onset with unknown aetiology. The hospital occurrence for equine lameness associated with bone tissue, joint and soft tissue was almost equal (28.36% each), followed by hard tissue (10.45%) and spinal affections (4.48%). Fractures were more common encountered in young equines followed by joint and soft tissue in adults. Fracture cases showed grade 5' lameness. Most of the cases of equine lameness (74.42%) had single radiographic lesion, whereas the remaining had multiple lesions involving one limb (6.98%) or more than one limb (18.60%). Majority of lameness arose from the joints of the right forelimb. The lame equines without radiographic evidence of bone/joint lesions had excellent outcome in 38.46% cases, medicinally. The equines treated surgically, had an equal of excellent, good and fair outcome (31.25% each) followed by poor (6.25%). In conclusion, the annual hospital occurrence of lameness in equine is alarmingly high (49.26%) in adult equines, Marwari breed and involving right forelimb. Coffin joint of forelimb and fetlock in hind limb are most frequently affected. Congenital affections like patellar luxation, fetlock joint laxity and flexor tendon contracture of distal limb have favourable long term prognosis with surgical intervention. Lameness associated with soft tissue lesions have favourable prognosis with medicinal therapy. High incidence of chronic and severe lameness lesions is the major reason for poor prognostic outcome or condemnation of the equines that suggest an urgent need to initiate client education/awareness programs; besides strengthening diagnostic and therapeutic facilities.

Key words: Athletic, arthritis, horse, occurrence, outcome, radiography, treatment

Signature of Major Advisor

Signature of the Student

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LIST OF ABBREVIATIONS

IVRI	:	Indian Veterinary Research Institute
n	:	Number
SDF	:	Superficial Digital Flexor Tendon
TB	:	thorough bred
Ma	:	Marwari
K	:	kathiawari
NM	:	nukra Marwari
ND	:	non-descript
Mu	:	Mule
M	:	male
F	:	female
BW	:	body weight in kgs
Age	:	in months
Duration of illness	:	in days
NK	:	not known
EIR	:	entangling in rope
AS	:	after shoeing
ST	:	Self trauma
HBH	:	hit by horse
T	:	trauma
WS	:	wobbler syndrome
LCJ	:	left carpal joint
HJ	:	hock joint
HRB	:	high ring bone
HJ	:	hock joint
CJ	:	carpal joint
PF	:	proud flesh
O	:	open
FD	:	fetlock dislocation
LOF	:	laxity of fetlock
STS	:	soft tissue swelling
RHF	:	right humerus fracture
BPL	:	bilateral patellar luxation
RT	:	right
MT	:	metatarsal
MC	:	metacarpal
FF	:	front fetlock
HL	:	hind limb
Sw	:	swelling
P	:	pastern
G	:	growth
FL	:	forelimb
RCRH	:	right carpal and right hock
HF	:	humerus fracture
LHP	:	left hock and pastern
LKH	:	left knee and hock

CHAPTER-I

INTRODUCTION

Lameness is an alteration in gait during motion or rest associated with a variety of ailments (structural or functional) involving any region of the limb (s) or spine (Baxter and Stashak, 2011). Horses, primarily being used for athletic/draught purpose, are prone to limb lameness. In developing countries like India, equine lameness is one of the most economically important medico-surgical conditions. Lameness leads to reduced performance, pain and progressive deterioration in the health and may lead to permanent disability in chronic untreated cases. Exact identification/localization of lameness is a crucial step for recommending appropriate medicinal or surgical treatment (Pfau et al., 2014).

The limb regions distal to carpus and tarsus are more prone to equine lameness. The foot does a variety of functions, including weight bearing during rest and motion, protecting the structures within the hoof capsule, absorbing concussion during racing or jumping, and providing traction (Redding & O'Grady, 2012). The equine foot has a complex anatomy of hoof capsule, sole, frog, digital cushion, ungual cartilages, and deep digital flexor tendon. These structures are also susceptible to damage due to trauma and/or various disease conditions such as infections (hoof abscesses, puncture wounds, and keratomas), white line disease, and canker.

Lameness affects all types of horses at some point of their life due to trauma (single event or recurrent work), genetic or acquired malformations, developmental problems, infections, metabolic changes, circulatory and neurological disorders, or combination of any of these factors (Mustefa, 2019). The podotrochlear syndrome is a pathological condition that affects the podotrochlear system which consists of the deep digital flexor tendon, distal digital annular ligament, podotrochlear bursa and sesamoidean ligaments along with distal sesamoid bone (Seignour et al., 2011).

Multimodal and systematic approach is recommended to make an accurate diagnosis of equine lameness that includes; primary complaint, detailed history, visual, physical and clinical examinations, radiography and ultrasonography (Amstutz, 1992). Careful evaluation of body symmetry and muscle anatomy is of paramount importance in comprehensive visual examination of a lame horse at rest in its stall followed by palpation (Mitchell, 2013).

The concept of diagnostic analgesia in lameness diagnosis helps to localize the source of pain (Smith, 2003). Diagnostic nerve block is done in a systematic manner to desensitize specific regions of the distal limb. It is started from the most distal end and progressed proximally till the desired results (partial or complete abolishment of the pain) are obtained (Baxter & Stashak, 2011). This technique is less popular in the field settings in India (Himani et al., 2019).

Radiography remains the most useful, economic and non-invasive diagnostic modality for the evaluation of the musculoskeletal disorders. Following preliminary localization of limb lameness by physical examination and diagnostic nerve and/or joint blocks, radiography is a quick and accurate method to provide morphologic characterization primarily of the bone/joint and to some extent the soft tissue abnormalities (Vallance et al., 2011). Good quality diagnostic radiographs help in formulating a treatment plan and subsequent assessment of the progression or outcome of the disease condition (Parks and Grady, 2003).

Ultrasonography has the potential to detect soft tissue damage as well as on bone surface in lame equines. Ultrasonographic features of the deep digital flexor tendon abnormalities (DDFT) include thickening of one or both lobes, longitudinal tears, focal or diffuse changes in echogenicity, irregularities of the dorsal border and adhesions between the DDFT and the proximal sesamoid ligament and/or distal sesamoid bone. The DDFT injuries are often associated with concurrent lesions of the podotrochlear bursa (acute to chronic bursitis) (Seignour et al., 2011).

Medication, rest, and supportive care, including adjustments in shoeing, are frequently recommended in the treatment of lame horses. Drugs that decrease discomfort and inflammation, enhance blood flow to the affected area, and aid in the healing of damaged tissue and joint fluid are recommended to treat lameness (Mustefa, 2019).

Unlike Western countries, the field of equine lameness in India is in a developing stage. One study reviewed demography and current status of welfare and research prospects of working ponies in Kashmir, India (Fazili & Kirmani, 2011). Another research paper found lack of farriery and trained manpower as the most ignored areas in equine husbandry practices (Mohite et al., 2019). Many studies emphasized to conduct focused research on working equines so as to educate poor

farmers about good husbandry practices including nutrition, healthcare, hoof care and shoeing, lameness and overall welfare in general (Whay et al., 2015).

Prevalence studies play a vital role in understanding relative frequency and severity of various disease conditions causing equine lameness that may vary from region to region due to variations in agro-climatic conditions, demographic factors and owner awareness. Such studies provide a comprehensive insight into the current situation and aids in the execution of future strategies. As per published Indian Veterinary literature, a few systematic studies on the occurrence and therapeutic aspects of equine lameness are available. Therefore, this study was planned with the following objectives:

- To investigate the occurrence of equine lameness associated with bones, joints and soft tissues at University Veterinary Hospital
- To evaluate long term outcome of various causes of equine lameness.

CHAPTER-II

REVIEW OF LITERATURE

An updated review of literature concerning various aspects of equine lameness has been discussed under various subheads as under:

- 2.1 Etiological factor for equine lameness
- 2.2 Incidence of equine lameness
- 2.3 Role of physical examination for assessing equine lameness
- 2.4 Gait analysis in equine lameness
- 2.5 Role of radiography in equine lameness
- 2.6 Diagnostic nerve and joint blocks
- 2.7 Ultrasonographic assessment of equine lameness
- 2.8 Therapeutic aspects of equine lameness

2.1 Etiological factor for equine lameness:

Rooney (1981) reported curb to be an important reason for lameness of hind limb in equines with sickle-hocks, thus making the tibio-tarsal angle narrow. Race horses are more prone to curb. The long plantar ligament of the DDFT, SDFT, tarsal sheath, and peri-tendinous / peri-ligamentous tissue may get affected by plantar soft tissue swelling.

Verschooten et al. (1984) found in an experimental study that the strain in interosseous tendons increases fetlock extension without altering the position of the distal aspect of splint bones and is the cause of distal splint bone fractures. It was also observed that the distal ends of splint bones are displaced outward when the fetlock is flexed. It was also hypothesized that the concurrent desmitis of suspensory ligament may also result in movement of splint bones. Fractures of splint bones are common due to trauma of external or internal origin. Severe desmitis of suspensory ligament, overextension of fetlock, pulling of interosseous tendons are also the likely reasons for splint bone fracture.

Honnas et al. (1992) studied septic arthritis of coffin joint in 12 horses and found that the etiology associated with it was either a faulty injection or trauma leading to open wound or direct contamination into the joint.

Larson (2011) reported genetic susceptibility, nutritional imbalances, rapid growth and physical damage as potential causes of wobbler syndrome or cervical vertebral malformation (CVM). Compression or malformation of the spinal cord, results in ataxia, spasticity, and incoordination in affected equines. There are two kinds of CVM; cervical static stenosis (CSS) and cervical vertebral instability (CVI). Spinal cord dynamic compression is caused by CVI and usually affects younger horses aged between 4 and 12 months. However, CSS affects slight older horses between 12 and 36 months of age. CSS is caused by the closure of cervical canal, putting pressure on the spinal cord. The occurrence of wobbler syndrome is proportional to the length of the horse's neck.

Down et al. (2007) reported side bone to be a condition in which the cartilages of the foot become ossified, and is encountered in big horse's front foot. Draught horses having angular limb abnormalities are prone to side bones in comparison to those having straight limb. The various factors attributing to side bone formation include genetic causes, concussion of hoof, incorrect shoeing, hoof disparity, and bad conformation. Lateral collateral cartilages are predisposed to side bones in comparison to the medial one.

Vanderperren et al. (2009) reported equine tarsus to be most commonly affected region of the hind limb lameness. Infectious arthritis of tarsocrural joint in foals is usually caused by haematogenous inoculation while the direct bacterial infection in the adult horses.

Redding and O' Grady (2012) stated that collateral cartilage are mostly affected by punctured wounds, abscess, laceration and hoof wall fissures. The chronic condition of thrush in draft horses is caused by trauma to the collateral cartilage leading to necrosis of the cartilages. The typical clinical appearance of thrush' is a persistent non-healing wound or abscess proximal to the coronary band over the lateral cartilage with discontinuous purulent drainage.

Mitchell (2013) found that the distal limb absorbs majority of the shock during locomotion and is the reason for higher occurrence of distal limb lameness in the athletic horses. There is a lot of P3 mobility inside the hoof wall due to the impact on landing and propulsion. Extremely abrasive footing surfaces can cause abnormal

motion and stress. Acute distal limb lameness, such as a P3 fracture or a foot abscess, are also commonly encountered in race horses.

Whay et al. (2015) conducted a study in and around the Jaipur city of India with an aim to decrease the risk factors for lameness in working horses. It was concluded that exploratory and participatory methods have great roles for educating animal owners and to encourage them to adopt improved husbandry practices.

Grady (2018) reported that thrush' is a bacterial infection that causes a degenerative disease in the epidermal tissue of frog. The bacteria can penetrate the dermis, the sensitive tissue beneath the frog's skin, causing pain and lameness in extreme cases. A frog that is healthy, well-formed has a broad, robust body that get misshaped when pressed with the thumb. The frog should occupy the space between the hoof capsule's heels, and its breadth should be at least 70% of its length when measured at its widest point. A sick frog is smaller and slacked below the level of the ground surface of hoofs, producing a gap in which foreign matter can accumulate. Other factors that contribute to thrush include moist, unsanitary conditions of stable; and a devoid of activity.

2.2 Incidence of equine lameness

Bjornsdottir et al. (2000) detected 30.3% horses to be having prevalence of osteoarthritis in the lower tarsal joints, radiographically, and its frequency was found to increase with advancing age.

Landman et al. (2004) studied equine lameness in 805 horses and correlated it with back problems. The prevalence of lameness was 74% in horses with a back condition, while back abnormalities were detected in 32% of the lame horses.

Dabareiner et al. (2005) reported that in equine lameness right forelimb was the most commonly affected, followed by the left forelimb, the left hind limb and the right hind limb.

Broster et al. (2009) described the range and incidence of pathological anomalies related to lameness in draft equines in developing countries like India (n = 110) and Pakistan (n = 117). The 98% horses demonstrated a variable degree of gait anomaly in all 4 limbs and in 87% cases in at least one limb. The horses showed severe lameness with a score of 3-4. The 94% equines had chronic joint illness and

83% with tendonitis of digital flexor involving at least 1 limb. It was concluded that high occurrence of multi limb lameness makes the diagnostic and therapeutic task complex and challenging.

Keegan et al. (2010) reported low inter-observer reliability of subjective method of evaluating equine lameness. A total of 131 adult horses were studied for lameness by 2-5 experienced doctors, who scored each limb on the scale of AAEP by first observing the horse trotted in straight path (round 1) and later completing a whole lameness evaluation (round 2). The clinicians agreed for detection of lameness in 76.6% and 72.9% times, after round 1 and 2 of lameness evaluation, respectively. Agreement of clinicians for the detection of forelimb lameness was slightly greater than that of hind limb lameness. A higher (93.1%) inter-clinician agreement was observed when mean lameness score was >1.5 as compared to when it was <1.5 (61.9%). On the basis of results of this study it was concluded that the reliability of subjective evaluation of low-grade lameness in equines is less. So evaluation of equine lameness subjectively by more than one observation must not be considered as gold standard.

Reix et al. (2014) evaluated 102 working draught donkeys in the region of Lahore, Pakistan with an aim to understand range and incidence of clinical signs related with lameness. The results revealed that all donkeys had gait abnormalities with 89% in all limbs, 92% had BCS of <2 (thin). The hind legs showed more lameness than front legs and severity of lameness was high in older equids aged >15 years. Besides, high prevalence of lameness/pain involving multiple limbs and conformational defects was highlighted from the welfare point of view in developing countries.

Mohsina et al. (2014) studied the prevalence of lameness in various animals species received at the Veterinary Polyclinic, IVRI, Izatnagar. The 21% had involvement of right hind limb (13%) followed by left forelimb (11%), right forelimb (17%), right shoulder (4%), weakness of hind quarter and bilateral forelimb affection, patellar dislocation (3%), ailments of bilateral hind limbs (9%), arthritis (5.5%), tenosynovitis and bone spavin, laminitis of forelimbs (7%) and right hind limb and quitter (4.5%). The findings revealed that lameness is influenced by breed, species, sex and age and right forelimb lameness is most frequently encountered in equines.

Himani et al. (2019) conducted a prospective radiographic study on 117 clinical cases of equine lameness cases presented at GADVASU during a period of 1 year. Out of the total equine presented, 78 equine (66.67%) were found with 124 radiographic lesions affecting 101 limbs. Most of the horses (62.8%) had single radiographic lesion while other had multiple lesions involving 1 (15.4%) or more limbs (21.8%). The hoof region had the highest percentage of lesions (25.81%), with fore feet being the most common (68.75%) and that too in mares (54.54%). Tarsus and fetlock regions were second (22.6%) and third (21.8%) most common regions found to be involved for equine lameness. The hind limbs fetlock joint (63%) was more affected than the forelimbs. The 15 horses were given 16 nerve/joint blocks, which helped in confirming lameness lesions in 66.7% of the cases. It was concluded that high prevalence of multiple lesions involving one or more limbs poses great diagnostic challenge. Forelimb hoof and the hock were most commonly involved in distal limb lameness in equine. Physical tests, nerve/joint blocks, and radiography all help to determine the location of the lesion that is producing lameness.

2.3 Role of physical examination in equine lameness

May and Wyn-Jones (1987) described the use of placement of markers at tuber coxae on both side to recognize the relative movements of the involved structures at trot. It helped in easy identification of the lame limb indicated by a constant rise in upward displacement to that of opposite healthy side regardless of source and severity of pain. The croup asymmetry was observed while trotting the horse away from the observer. When the weight was born by lame limb, the croup was lifted, but when the weight was switched to the sound leg, the croup descended.

Busschers and Van Weeren (2001) stated the importance of flexion tests in the identification of lame limb on 100 horses. The various factors related to examiner such as force and time used to perform flexion test was reported to have significant impact on the test's outcome. It was reported that the most clinically healthy horses may also have a (slightly) positive flexion test of the lower limb which raised a doubt on the assumption that a positive flexion test suggests the presence of subclinical joint abnormalities.

Al-Derawie (2012) studied clinical, biochemical and hematological changes associated with acute laminitis in in drought horses. In-appetence, pain at coronet on

palpation, abnormal stance and elevated temperature, respiratory and heart rates were observed with biochemical changes in the parameters.

Dyson (2002) studied the lameness pattern arising from pelvis and stifle. Pain in stifle joint causes the horse to stand with their stifle turned outwards. Distension of femoropatellar and medial femorotibial joint capsule also occurs. A horse suffering from acute stifle pain may only be able to stand on his toes. It was recommended palpating the stifle joint with the limb in a normal weight bearing posture. Abduction of the limb may induce pain due to damage to the medial collateral ligament of the stifle joint.

Hammarberg et al. (2016) stated that the circular path may exacerbate low-grade lameness, so longeing should be considered a vital aspect of lameness examination. Subjective evaluation of lameness during straight line movements is less reliable due to inter-observer variations. It may be difficult to appreciate vertical movement of the pelvis in horses having mild lameness of hind limb, when the lame limb is outside; however, marked asymmetry is detected when the horse is lounged with the lame limb inside.

Baxter et al. (2011) suggested conducting physical examination of limb and axial skeleton including examination with hoof tester before exercising the horse. Initially examination at rest on a flat surface, followed by observing the horse in various gaits such as straight walk, trot/lope, and circling are advised. The body type, conformation and postural changes are noted before conducting palpation examination. It is critical to search for changes in the limbs' contours and asymmetries. Feet are examined for signs of abnormal wear, heel bulb contraction, hoof cracks, imbalance, and size. The muscles of each limb should be evaluated and compared to that of opposing limb.

2.4 Gait analysis in equine lameness

Pratt(1983) described that gait is controlled by nerve centers in spinal cord. These nerve centers control rhythmic motion of all four legs and each leg generator are coupled together for gait. The movement of limb is divided into flexion and extension phase. The beginning of flexor phase is marked by initiation of swing phase and is controlled by flexor muscle and tendon. Movement of limb cranial to body is protraction and caudal to body is retraction. The flexor phase ends at protraction of

swing phase. The extension phase starts as the limb touches ground. In extension phase load of animal is totally over limb and it ends when fetlock starts to flex.

Buchner et al. (1996) studied supporting limb lameness of each limb of eleven clinically non-lame Dutch Warmblood equids to gain sight into the compensatory mechanisms horses used to minimize lameness and to evaluate limb kinematic factors for their importance as lameness indicators. The pattern of movement of hoof and joint angle were observed by use of joint angle/time diagrams and the trajectories of hoof in the sagittal plane. The lame limb either fore or hind both show marked reduction of extension of the fetlock joint and flexion of the coffin joint during the stance phase whereas contralateral non lame limb show marked increase in extension and flexion of joint. As more the joint is proximal such as shoulder and tarsus, more is flexion of lame limb. The arc of foot flight is also reduced in lame limb in comparison to that of non-lame limb.

Ishihara et al. (2005) subjected equines to kinetic gait analysis using ground reaction force measurements collected using a force plate of normal gait and limp. The technique helped clinicians diagnose the lameness status and its cause in horses.

Baxter et al. (2011) reported the criteria of the American Association of Equine Practitioners (AAEP) to grade lameness on a scale of 0 to 5:

- 0 - Lameness undetectable at any conditions
- 1 - Lameness hard to detect; it is not always visible regardless of the situation (i.e. circling, weight carrying, inclined path, rigid surface etc.)
- 2 - Lameness is hard to detect during a walk or trot in a straight path; however, it is consistently visible in particular situations (e.g., circling, weight bearing, inclines, hard surfaces etc.)
- 3 - Lameness consistently seen at a trot in all situations
- 4 - Overt lameness, as evidenced by hitching, nodding or a shortening of stride
- 5 - Inability to move; minimal weight-bearing in action and/or at rest

Clayton and Hobbs (2019) reported biomechanical classification of diagonally coordinated gaits in dressage horses with regard to passage, trot and piaffe. It was conducted that data on both trot and passage was same so was classified as running

gait. The piaffe gait was classified as a walking gait as limbs has relatively long stance durations and no aerial phases.

Braganca et al. (2020) reported improvement in gait classification (GC) using inertial measurement unit. A total of 120 horses of 4 different breeds of domestic origin equipped with seven motion sensors and 7576 strides from eight different gaits. The best GC model attained 97% accuracy. It was concluded that GC helped in-depth biomechanical studies and allowed for high accurate phenotyping of gait for research on genetic and breeding basis.

2.5 Role of radiography in equine lameness

Jeffcott (1975) described radiography of spine for back pain. A Siemens Triplex Optimatic 1023' was used to take radiographs of the vertebral column placed on a 3D suspension with a 200KV/1000mA tube. Due to this arrangement the center ray was projected to the middle of the screen automatically. High ratio grids helped in the deduction of scatter radiation.

Edwards (1984) recommended 4 views for the radiography of the fetlock and pastern joint: lateral to medial (LM); cranio-caudal (anteroposterior - AP); and two oblique. The primary beam is projected in the cranio-caudal lateromedial (APLM) and cranio-caudal mediolateral (APML) directions for oblique views.

May et al. (1986) recommended orthogonal views for radiography in equine lameness. Alone latero-medial and cranio-caudal views or dorso-palmar/dorsoplantar views results in many false positives due to which many minor and even serious, lesions sometimes are undiagnosed. Thus, oblique views can help to clear any misunderstanding about a suspicious shadow detected on another film. It was recommended to look for two key alterations in a structure on oblique views– a shift in opacity and a shift in outline.

Turner (1989) described evaluating the navicular bone and surrounding structures using different imaging facilities. Radiography was described the best. The changes encountered related to navicular syndrome are of 5 types; bony spurs at extremities of navicular bone, joint mice at upper and lower ligament attachment at respective border of navicular bone, distended synovial sheath, cyst formation and flexor changes.

Cripps and Eustace (1999) described Laminitis-related radiological measures taken from the feet of healthy horses. Three angles and three distances were measured from the foot of 25 normal horses using latero-medial radiography projections. In the front foot of a sound horse, the average wall thickness was 14.6mm and more than 16.6mm was suggestive of laminitis.

Björnsdóttir et al. (2000) investigated a population of 614 horses aged 6–12 years (mean age = 7.9 years) with degenerative joint disease (DJD) in the distal tarsal joints, as well as the relationship between radiographic and clinical indications compatible with the condition. A clinical examination, comprising probing of the medial side of the distal tarsus and motion evaluation of the distal tarsus, was performed, as well as radiographs with three projections of each tarsus. DJD of distal tarsal joint was recorded in 30.3% of the horses and the frequency was closely linked with age. Peri-articular osteophytes, sub-chondral bone erosion as well as narrowing of joint space were described as the radiographic features of DJD in the distal tarsal joint.

Page and Hagen (2002) reported the effect of hoof break over on structures and forces inside the foot. The most proximal region of the solar aspect of the hoof capsule that contacts the surface is known as break over. Both forelimbs and hindlimbs were aimed at equally weight distribution. Lateral-medial radiographs were taken with both bulbs of the heel parallel to the radiograph beam and the radiographic cassette touching the hoof capsule.

Dakin et al. (2006) reported fracture of side bones in 10 horses. Latero-medial, dorso-proximal-palmaro-distal oblique and weight-bearing dorso-palmar views, oblique views of the inter-phalangeal joints with the foot flexed were done in all the equines. The medial and lateral cartilages of all horses had moderate to severe ossification, which was often symmetrical in degree. The medial cartilage fracture was the most common of the 12 fractures found in ten horses compared to the lateral side. Fractures were distinguished from distinct ossification centers by a radiolucent line within the ossified cartilage. The outline of the fracture tended to be sharp in compared to the more evenly distributed separate ossification centers. All of the fractures were non-articular, non-displaced, and uncomplicated.

Dakin et al. (2006) reported diagnosis of fracture of ossified cartilages of foot in 10 horses using nerve/joint blocks, radiography, scintigraphy and MRI. It was concluded that this condition should be involved in the differential diagnosis of equine foot lameness. Generally radiography is sufficient to detect fractured cartilage but in some difficult cases associated with presence of separate centers of ossification, scintigraphic examination is preferred for confirmatory diagnosis. MRI is necessary when concurrent injuries are suspected within the hoof capsule that fails to be detected using radiography, scintigraphy or ultrasonography. Early diagnosis bears good prognosis.

Vallance et al. (2011) reported that survey radiographs help in defining the morphology of bone and soft tissue anomalies rapidly and correctly, allowing for the formulation of a conclusive or differential diagnosis.

Himani et al. (2019) radiographically investigated 117 clinically lame horses, and found radiography to be a good diagnostic aid that helps in confirming multiple lesions involving one or more limbs.

2.6 Diagnostic nerve and joint blocks

Honnas et al. (1992) reported reduction in severity of lameness to half by blocking plantar or palmar digital nerves at region of the pastern for septic arthritis in equines (n=12).

Arkell et al. (2006) reported the biasness during evaluation of equine lameness through local anesthetic nerve blocks. Eighteen clinicians were subjected to grading lameness in allotted 8 horses on a scale of 0 to 10. The similarity of the assessments made by individual clinician were good, with a mean of 0.6 of a grade difference during grading the similar horse on 2 occasions. The harmony between assessments of 4 orthopedic experts were reasonable (± 1 grade), but markedly poorer for 4 non-experts and ten final year veterinary students.

De Grauw et al. (2006) stated that localization of articular pain is critical in the diagnosis of joint illness in horses and regional and intra-articular anesthetic are used extensively in clinical examination of lameness. Intra-articular anesthesia (IAA) was preferred over peri-neural nerve blocks as it is more selective for intra-articular

localization of a painful process and also distinguishes between intra- and peri-articular inflammations.

Harper et al. (2007) described the effects of digital flexor tendon sheath analgesia on pain in horse sole, coffin joint and podo-trochlear bursa. It was concluded that lameness pain originated from sole, coffin joint, or podo-trochlear bone responds poorly to DFTS analgesia.

Byam- Cook and Singer (2009) reported intra-articular anesthesia response to be the gold standard for diagnosing DJD of tarsal joints. In horses with DJD of tarsal joint, there is no link between the life span and severity of lameness, the reaction to intra-articular anesthetic, and radiographic results.

Mitchell (2013) reported that a lack of response to the distal digital nerve block does not rule out the foot as a source of lameness. It was opined that serious conditions like hoof abscess required more proximal anesthesia. It was recommended to compulsory go from distal to proximal while applying diagnostic analgesia.

Schumacher et al. (2013) reported that analgesia occurs within 5 minutes of injecting a local anesthetic solution inside joints or surrounding nerves in the lower area of the leg. Therefore, gait must be examined within 10minutes. Rather than simply posterior half of foot, a palmar digital nerve block anaesthetizes the entire foot, including the coffin joint. The palmar digital nerves must be anaesthetized close to the upper margin of collateral cartilages to prevent anaesthetizing pastern joint.

Silva et al. (2015) used lidocaine (20mg/ml), bupivacaine (5mg/ml) and ropivacaine (7.5mg/ml) in different doses for evaluating palmer digital nerve blocks in 9 horses. Bupivacaine and ropivacaine were considered stronger anesthetic than lidocaine.

Himani et al. (2019) performed 16 joint/nerve blocks in 15 equids with 66.7% success rate in diagnosing lameness.

2.7 Ultrasonographic assessment of equine lameness

Dyson et al. (2004) described the clinical signs of horses with desmitis of collateral ligaments of coffin joint in 18 horses using USG, Scintigraphy and MRI examination. The USG alone could diagnose desmitis in 3 horses only while USG in combination with MRI in 7 horses and 8 horses using MRI alone.

Seignour et al. (2011) reported that since ultrasonography has the ability to detect any injury to soft tissues, it has become popular in the investigation of numerous podo-trochlear injuries, ligaments and tendons. Inflammation of either one or both lobes, longitudinal rips, isolated or diffuse alterations in echogenicity, anomalies of the upper border, and adhesions present between the DDFT and the upper sesamoidean ligament or navicular bone are all ultrasonography findings of the DDFT affections. DDF tendon injuries are frequently accompanied with navicular bursa lesions. On observing the physical symptoms of foot disease such as palmar aspect is swollen, pastern pain, increased foot heat, and pain at rest etc; an ultrasonographic examination of palmar region of foot must be performed. A convex probe of 7.5 mhz is used. To generate an inter-phalangeal joint extension, the limb must be flexed and held with toe on operator's knee.

Smith (2003) described the pathology of tendon and ligament on basis of: echogenicity, size, pattern, vascularity, shape, position and margination. Hypoechoic change indicates an acute injury, whereas a diverse pattern of variable severity of hypo-echogenicity and hyper-echogenicity indicate chronic. Adhesions can also change the tendon's location within tendon sheaths.

Padaliya et al. (2015) conducted ultrasonography of palmer tendons in 40 mature horses, using a linear transducer with a frequency of 10-18 MHz and an L52 linear array transducer having frequencies of 8 - 10 MHz. In transverse scanning, the palmar tendon was separated into 7 levels from below to accessory carpal bone to ergot, and 3 levels in longitudinal scanning. The USG examination was helpful in diagnosing chronic bowed tendon, desmitis of suspensory ligament, tenosynovitis of carpal sheath, and digital sheath effusions. The mean cross-sectional area (cm²) of damaged tendons was substantially higher than normal tendons.

Machado et al. (2016) described the diagnostic value of tomography, x ray and USG in fetlock joints affections in 20 horses. Computed tomography was proved the best due to 3 dimensional picture/image of fetlock.

2.8 Therapeutic aspects of equine lameness

Edwards (1982) described the procedure of surgical arthrodesis/joint fusion for the treatment of bone spavin in 20 horses suffering from osteoarthritis with little or no indications of periostitis. Three of the horses remained lame a year later. The rest went back to work, however one of them developed spavin in the other hock and was euthanized. The earliest recover to soundness was 3 months, while the longest was 10 months.

Firth (1983) reported infectious polyarthrititis in foal. It was recommended to give high dosage antibiotic at an early stage for at least 2-4 weeks. Antibiotics used intra-articularly during arthrocentesis are presumably safe as long as the method is sterile and painless.

Bertone et al. (1985) reported the treatment of angular deformities of carpus, tarsus and fetlock joints in 27 foals using periosteal transection and stripping. A total of 81.5% cases showed soundness in term of straight limb.

May (1986) reported treatment for lameness to be symptomatic, providing just temporary alleviation.

Turner (1989) recommended about the treatment of navicular disease using medicinal, shoeing and surgical approaches. For shoeing, the best goal to be achieved is to raise heel 2-4 degree and roll the toe of shoe that can be achieved using egg bar shoe. Medicinal approach involves use of injecting steroid into navicular bursa, NSAIDs and connective tissue supplement.

Hunt (1993) stated that in the treatment of recurrent laminitis in horses, a mid-metacarpal DDF tenotomy is used. The procedure was carried out on 20 horses and within 72 hours, 16 horses improved, 1 horse deteriorated, and 2 horses remain unaffected due to the operation. Eleven horses died within one month of operation, and six horses lived for more than six months. Three horses stayed lame after surviving for more than six months, and none restored to athletic performance.

Larson (2011) described that drugs like mannitol, DMSO, diurectics and steroids can be used to decrease the swelling of neuronal tissue for wobblers syndrome. The surgical method for the treatment of wobbler aims at fusing the vertebrae (Cloward method) by making a hole between the afflicted vertebral bodies from

beneath the neck and inserting a “Bag by Basket” stainless steel prosthesis which fuse vertebrae and they become immobile.

Pothiappan et al. (2012) treated a case of bog spavin using 2 ml (total dose) inj. esgipyrine 10 ml for 5 days on alternative basis after emptying the serous fluid from the joint and applying crepe bandage. The treatment was repeated at 2 weeks and was successful.

Rahman and Reed (2014) studied issues related to the welfare and management of the draught animals and concluded that it can be achieved by proper veterinary care, advices on health practices involving care of foot, proper shoeing and maintenance of harnesses.

Niemelä et al. (2016) conducted a study to evaluate the effect non-animal stabilized hyaluronic acid in the fetlock joint of lame equines (n=21). Horses (n=14) received 3ml of NASHA intra-articularly, while the control group (n=13) received equal volume of sterile NSS. NASHA was reported to provide symptom-modifying and disease-modifying effects. The follow up outcome at 3 months reported 67% success rate.

Mohite et al. (2019) studied status of farriery services and trained manpower for equine in Uttarpradesh district of India. Farriery was reported one of the most ignored areas in equine husbandry practices and lack of adequate trained manpower a serious issue in developing countries like India.

Grady (2018) reported strategies for the treatment of thrush that include enhancing the frog's hoof capsule, palmar/plantar foot conformation, and overall health. It was observed that if the frog is buried beneath the foot's ground surface, management of thrush is not effective. It was recommended to take off the shoes from the horse which is off-work; besides the heels clipped to the same plane as the frog and the hoof wall perimeter rounded. The necrotic area of frog affected with thrush should be debrided along with the daily dressing with copper sulphate, magnesium sulphate and chlorhexidine.

CHAPTER-III

MATERIALS AND METHODS

The study included 67 clinical cases of equine lameness presented to the Department of Veterinary Surgery and Radiology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana during the period of 12 months of study (February 2020 to June 2021; excluding March, April, May and June months due to Covid-19 lock down period). A total of 5925 cases of large animals (including bovines, equines and caprine) were presented during the one year at the University Veterinary Hospital which included 136 clinical cases of equines that were suffering from various disease conditions such as lameness, colic, respiratory disorders, pharyngitis, dystocia etc.

This clinical study was duly approved by Institutional Animal Ethics Committee. The equine lameness cases were subjected to systematic evaluation including physical examination (palpation, flexion tests), assessment of lameness at various gaits, radiography, nerve and joint blocks, ultrasonography and blood test as per the need of the cases with the objective to record the hospital occurrence of equine lameness associated with bones, joints, spine, soft and hard tissues. The occurrence of lameness arising from various regions of the all the four limbs such as hoof, pastern and fetlock, carpal, metacarpal, elbow, shoulder of forelimb and hoof, pastern, fetlock, tarsus, metatarsus, stifle region of hindlimb were recorded.

The lameness cases were evaluated on the basis of following parameters:

1. **Signalment:** Detailed signalment of age, sex, breed and species were recorded in all animals at the time of initial presentation of the case.
2. **History:** Detailed history pertaining to onset and progression of lameness in all the animals was extracted from the owners and the following observations were recorded.
 - a. **Type or use of equine:** Racing/ Breeding/ Draft/ Young animal in equine was recorded.
 - b. **History of injury:** Any recent injury to the animal was recorded.

- c. **Duration of illness:** Duration of illness (days) was recorded according to the symptoms first seen by the owner to the presentation of case.
- d. **Feed and water intake:** The feed and water intake of animal was recorded to correlate the lameness with any systemic illness.
- e. **Type of feed:** Concentrate, green fodder, milk, whole grain etc.

3. Gait abnormalities / Weight bearing

- a. **Examination at rest:** All the equines were first examined at rest. A close visual examination was made with animal standing squarely on a leveled surface at rest. The animal was first examined at a distance and then close up viewing the animal from all directions. From a distance overall condition of body and changes in posture, pointing, and weight shifting was noted. The evaluation of the animal was carried out on a hard level surface.
- b. **Examination at exercise:** Visual examination of the equine at exercise was done to note the gait characteristics of all limbs, extent of lameness or shambling of movement. The equine was evaluated at walk and trotted in a linear path, and then lunging in circles. Gait asymmetry, Head nodding, alteration in height of foot flight, length of stride, weight bearing, gluteal hike was noted.

On the basis of the examination of equine at rest and exercise, the scoring of lameness was done using AAEP grading system for grading of Equine lameness (Stashak 2002) as depicted in the Table 1.

Table 1: AAEP grading system for grading of Equine lameness (Stashak 2002)

Grade	Description
0	Lameness not detectable under any condition
1	Lameness hard to note; evident while trotting under certain conditions (i. e. circling inclines, weight carrying, hard surfaces etc)
2	Lameness hard to note at walk or while trotting in linear path; consistently evident while walk and trotting under certain conditions (i. e. weight carrying, circling inclines, hard surfaces etc)
3	Lameness detectable at a trot under all conditions
4	Marked lameness: obvious nodding, hitching, or shortened stride
5	Minimal weight-bearing evident at motion or at rest; decreased ability to move

All horses were evaluated physically. The palpation was done, from upward to downward in weight-bearing, and then downward to upward with the limb lifted up or non-weighted in both fore and hind limbs.

- i. Hoof:** The sole of the foot was examined to check the presence of any lesion. The foot pain response at various regions of the hoof was checked with the use of hoof tester (Fig. 1). The coronary band was palpated for inflammation, rise in temperature and pain on pressure.
 - ii. Pastern:** Palpation of dorsal, lateral and medial surface of proximal interphalangeal joint was done for heat and enlargement. The extensor and flexor tendons and sesamoidean ligaments were also evaluated.
 - iii. Fetlock:** The plantar/palmar and dorsal pouches of the fetlock joints were palpated. The flexor tendons and branches of suspensory ligaments and digital flexor tendon sheath were also evaluated.
 - iv. Metacarpus/Metatarsus:** Palpation of the dorsal aspect of the metatarsal and metacarpal was done to evaluate the extensor tendons. Palmar/Plantar surface was evaluated to check the lesion of tendons and ligaments and distension of carpal and DDFT sheaths.
 - v. Carpus:** The dorsal and palmar joint pouches and tendon sheaths of the extensor tendons were evaluated for any disease condition. The carpal canal was palpated for pain or distension.
 - vi. Tarsus:** The dorsal, plantaromedial and plantarolateral joint pouches and the tendon sheaths of the flexor and extensor tendons were evaluated.
- c. **Flexion tests:** The flexion tests were performed to check the degree of movement of joints and pain response. The flexion tests were performed in the affected limb. The contralateral limb was also evaluated. Various flexion tests regardless of location were performed for 1/2-1 minutes.
- i. Distal limb / Phalangeal / Fetlock flexion (Fig. 2a):** Flexion of metacarpophalangeal/metatarsophalangeal joint was done by placing a hand on dorsal metacarpus/metatarsus and pull up the pastern with the other hand. Flexion of joint below fetlock were done by maintaining fetlock in extension by placing one hand on fetlock whereas flexing the phalanges by pulling up on the toe with the opposite.

- ii. **Carpal flexion:** The carpal flexion was done by holding the metacarpus with one hand and pulling up on lower limb with other hand by making the foot to touch the posterior aspect of olecranon. The knee joint was held in position for 60 seconds and animal was made to walk briskly.
 - iii. **Tarsal/Hock flexion/Spavin test:** Hock flexion (Fig. 2b) was performed by holding the planter surface of metatarsus and lifting the limb to flex. The metatarsus was kept parallel to the ground and held in position for 1 minute.
 - d. **Extension test:**
 - i. **Hock Extension Test:** It was performed in equine that kept the hock extended to check the patency of peroneus tertius tendon. If rupture, the hock would extend without simultaneous extension of stifle joint.
4. **Hematological parameters:** The lame horses showing clinical signs of reduced appetite or were suspected to be systemically ill were subjected to hematological examination to determine hemoglobin (Hb g/dL), total leukocyte count (TLC/ μ L) and differential leukocyte count (DLC %). The 2ml of Blood samples were collected under aseptic condition from jugular vein and were subjected to routine hematological evaluation using standard methods.
 5. **Serum Biochemistry:** Serum was collected for evaluating the parameters of BUN and creatinine
 6. **Radiography:** The cases suspected for musculoskeletal system ailments were subjected to radiography. Two orthogonal views i.e. lateral and dorsopalmar/dorsoplantar radiographs were obtained in standing equines (Fig. 3). Additional oblique views were also obtained as per the individual requirement of the case. Furious equines were sedated with inj. xylazine hcl (0.5 mg/kg, IV) to facilitate for radiographic positioning in standing animals.
 7. **Nerve blocks:** In this study, nerve blocks were used in 5 cases to confirm, whether the radiographic lesion was actually the initial cause for lameness or not. Single appropriate nerve block was applied in obviously lame horses i.e. those having lameness of grade 3 to 5. Just before the nerve block all the lame horses were evaluated in various gaits and video recording was done. Following nerve blocks, as per the site of lesion, the gait of the lame horse was again assessed to

localize site of the lameness in the lower limb. The various nerve blocks were performed as per the standard procedures.

Restraint of the horse: Horses were restrained in standing position by lifting one of its limb and use of twitch on the lip or ear for nerve or joint blocks.

Preparation of site of nerve/joint block: The area at the site of injection was prepared aseptically by clipping hair followed by scrubbing with Savlon solution and painting with spirit (70% ethyl alcohol) or betadine (5%povidone-iodine)lotion.

Local anesthetic used: The local anesthetic, bupivacaine (0.5%) was used for the nerve and joint blocks (Fig. 7). The needle size, length and volume of the drug varied according to the site of injection.

A. NERVE BLOCKS

The various nerve blocks on the distal limb were performed as per the standard procedures described by Barker (2016).

a. Palmar Digital Nerve Block (n=2) (Fig. 4a)

The palmar digital nerve block was performed on the axial and abaxial sides. Needle size used was 25 gauge x 2.5 cm and local anesthetic (bupivacaine) solution volume used was 2 ml. With the limb lifted above the ground, neurovascular bundle were palpated one cm abaxial to margin of DDFT sheath. The bundles were bit easier to palpate under mild tension that was attained by mildly extending the digit. Within neurovascular bundle, nerve was located medial to the artery and vein. The needle was inserted in a proximo-distal direction at an acute angle of about 40 degrees to skin surface at the site of collateral cartilages and the local anesthetic was injected in the subcutaneous space. Before injecting local anesthetic, it was ensured that no blood vessel was punctured. If blood was noted in the hub of needle or obtained on aspiration, the needle was redirected medially.

b. Low four-point nerve block: (n=2)

This block desensitized Palmar/plantar and metacarpal/metatarsal nerves on the axial and abaxial sides at above the fetlock joint.

Palmar/plantar nerves: The needle size of size 25 G x 2.5 cm was used with local anesthetic 2 ml. The palmar/plantar nerves (abaxial and axial) were located in the groove present between the deep digital flexor tendon (DDFT) and the suspensory ligament (SL). Inside this groove, anesthetic solution was injected subcutaneously, proximal to the upper reflection of DDFT sheath (2 cm proximal to the splint button, so as to prevent digital sheath). This was done with the leg lifted up or with a horse resting on limb. Both nerves were located separately from their respective sides or a single needle used from the abaxial side to block the abaxial palmar nerve first and then passed between SL and DDFT to reach the axial palmar nerve. Care was taken to direct the needle upward to prevent insertion of the dorsal aspect of the DFTS.

The palmar metacarpal nerves (abaxial and axial), course downward on the medial side of the splint bones, and were reached at the site of the splints button. At this particular site, the needle was directed in a dorsal direction under the splint to prevent inadvertent insertion of palmar pouch of fetlock joint.

c. High four point nerve block (n=1)(Fig. 4b and c)

This block desensitizes Palmar/plantar and metacarpal/metatarsal nerves on the axial and abaxial sides slightly lower to knee joint.

Plantar nerves: A 25 G x 2.5 cm needle was introduced through fascia near the dorsal boundary of the deep digital flexor tendon to anaesthetize a palmar nerve, and 2 mL of anesthetic solution was deposited on the nerve.

The plantar metatarsal nerves (abaxial and axial): The flexor tendons and inferior check ligament get desensitized when the medial and lateral plantar nerves are anaesthetized. The palmar metatarsal nerves are anaesthetized distal to the level of the knee joint while the limb is gripped or bearing weight using 25 x 2.5cm needle into angle formed between 3rd metatarsal and both splint bones. The splint bones and their interosseous ligaments, as well as the proximal aspect of the suspensory ligament, are desensitized when the medial and lateral plantar metatarsal nerves are anaesthetized alone.

- 8. Ultrasonography (n=6):** Ultrasonographic examination (Fig. 5a) using Wipro logiq F8 machine with a linear 7.5MHz transducer, was done to evaluate the soft

tissue structures like tendon, ligament and navicular bursa. Horses were restrained properly in the Travis. A suitable area was clipped followed by application of coupling gel over area and transducer for scanning the desired region in transverse and longitudinal planes. Various affections like tendinitis, sheath distension due to fluid accumulation, navicular bursa distension, tears of ligament and tendon etc (Fig. 5b) were diagnosed.

- 9. Treatment:** Out of 67 cases presented during the period of study, 24 cases with chronic and severe conditions were advised for culling/euthanasia. Out of these 3 cases were euthanized and remaining prescribed conservative medications only.

The remaining (n=43) cases were treated using A) Medicinal or B) Surgical interventions.

A. Medicinal treatment (n=20): The cases with lameness grade less than 2 and acute in onset, without radiographic involvement of bones and joint were treated with medicines. Radiography ruled out any bone and joint pathology and these cases were suspected for affections like soft tissue trauma, back pain, bog spavin. The medicines like antibiotics, NSAIDs, nerve tonic, steroids, farrier formula, synovial fluid supplements were used in these cases.

B. Surgical treatment (n=23): Suitable surgical intervention(s) was done under sedation or general anesthesia to treat various disease conditions using standard methods as per existing facilities and need of the case. The details of surgical cases are depicted in Table 2.

Table 2. Details of various surgical conditions in equines

S.No.	Disease Condition	No. of Animals
1	Canker	2
2	Bilateral Patellar Luxation	1
3	Broken hoof with granulation	1
4	Partial sdf tear	1
5	Contracted flexor tendons	5
6	Compound fetlock dislocation	2
7	Fractures	5
8	Laxity of ligament	3
9	Growth at fetlock	1
10	Broken hoof	1
11	Thrush	1
Total		23

10. Data Processing and Statistical Analysis: The objective data recorded was analyzed using Mean and standard deviation calculated in Microsoft Excel 2010. The subjective data was analyzed on percentage basis: relative and absolute.

CHAPTER-IV

RESULTS AND DISCUSSION

The one year study including the clinical cases of equine lameness presented to the department of Veterinary Surgery and Radiology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana are presented and discussed under various subheads as below:

Hospital Occurrence for equine lameness (Table 3)

The study included 67 lame equines that were admitted during the study period of 12 months (excluding the lockdown months of March, April, May and June 2020). A total of 5925 large animals (including bovines, equines and caprines) were enrolled at the University Veterinary Hospital and it included 136 clinical cases of equines suffering from various disease conditions such as lameness, colic, respiratory disorders, pharyngitis, dystocia etc thus equines constituted 2.30% (136/5925) of total annual clinical cases load. Out of 136, 67 equines were lame. Thus the hospital occurrence of equine lameness was calculated as 1.11% (67/5925) among total large animals enrolled and 49.26% (67/136) among equine patients presented for different clinical ailments during one year of study at university veterinary hospital (Fig. 6). On the contrary, Mohsina et al. (2014) reported a very high occurrence of equine lameness i.e. as 21% among all the animals presented at a referral institute in India. The detailed distribution of lameness cases is discussed further under various subheads:

Breed wise distribution of equine lameness (Fig. 7): Among various equine breeds presented for lameness, the Marwari was maximum presented (n=22; 32.83%) followed by the thoroughbreds (n=17; 25.37%), Nukra (n=13; 19.40%), non-descript/crossbred (n=11; 16.44%), mule (n=3; 4.47%) and a Kathiawari (1.49%). The variation in relative frequency of lameness based on breed might be due to people's preference to a particular breed(s). The common local breed of the area is Marwari so this could be the reason for its most presentation. The thoroughbred horses are usually kept by the government organizations like ITBP, BSF and Police which are used for patrolling along borders areas. In contrast, the study conducted by Mistry et al. (2012), on 176 equines, highest incidence of lameness was recorded in non-descript (28.49%) followed by Marwari (9.09%), Kathiawari (1.70%) and thoroughbred (0.57%).

Table 3: Table showing the analysis of signalment and history of equines presented for lameness

Parameter	Group	Number	Per cent
Breed	Thoroughbreds	17	25.37
	Marwari	22	32.83
	Nukra Marwari	13	19.40
	Kathiawari	1	1.49
	Mule	3	4.47
	Crossbred	11	16.4
Gender	Male	30	44.77
	Female	37	55.22
Age (Month)	≤ 1 month	7	10.45
	>1- 6 month	4	5.97
	>6-12 month	4	5.97
	>12-60 months	18	26.86
	>60 months	34	50.75
Work	Racing	27	40.30
	Draught	8	11.94
	Breeding	15	22.38
	Young	17	25.38
Duration of illness	<3 days	19	28.35
	3-10 days	8	11.94
	10-30 days	16	23.88
	>30 days	24	35.82
Diet	Mix	54	80.59
	Whole grain	2	2.98
	Milk	11	16.42
History / Etiology	Fall	11	16.42
	Unknown	21	31.34
	Miscellaneous	20	29.85
	Self trauma	3	4.48
	Trauma	7	10.45
	Congenital	5	7.46
Diagnosis	Bone	19	28.36
	Joint	19	28.36
	Soft tissue	19	28.36
	Hard tissue	7	10.45
	Spine	3	4.47
	≤1 month (n=6)	Bone	2=28.57%
		Joint	2=28.57%
		Soft tissue	2=28.57%
		Hard tissue	0
		Spine	1=14.28%

Diagnosis as per age	>1- 6month (n=4)	Bone	3= 75%
		Joint	0
		Soft tissue	1=25%
		Hard tissue	0
		Spine	0
	>6-12 month (n=4)	Bone	1=25%
		Joint	1=25%
		Soft tissue	1=25%
		Hard tissue	0
		Spine	1=25%
	>12-60 months (n=18)	Bone	3=16.67%
		Joint	5=27.78%
		Soft tissue	7=38.89%
		Hard tissue	2=11.11%
		Spine	1=5.55%
	>60 months (n=34)	Bone	10=29.41
		Joint	11=32.35
		Soft tissue	8=23.53
		Hard tissue	5=14.70
		Spine	0

Gender wise distribution of equine lameness: The females were slightly higher in presentation 55.22% (n=37) than males 44.78% (n=30) (Fig. 8). The local people mostly prefer keeping females, as these are easy to manage than Stallions. The study conducted by Varshney (1997) and Himani et al. (2019) also showed higher incidence of equine lameness in females as compared to males.

Age wise distribution of equine lameness (Fig. 9): Most lameness affected equids were more than 5 years of age (50.75%) followed by those between one to five years of age (26.86%), young equines of less than 1month of age (10.45%) and the minimum were foals of 1-6 months (5.97%) and 6-12 months of age. The mean age of equine presented was 68.23 ± 54.46 months ranging from 4 days to 204 months (16 years) on contrary Cogger et al. (2008) demonstrated highest incidence of lameness in young adult horses aged less than 2 years followed by 6-8 years age group. These findings corroborate to Himani et al. (2019) but Cogger et al. (2008) reported high prevalence of lameness in less than 2 year old equines.

Work/purpose wise distribution of equine lameness (Fig. 10): Based on the work assigned/purpose of using equines, these were mostly racing or sports events for Thoroughbred equines (40.30%) followed by 23.88% young equines. The Marwari horses used for breeding were 22.38%, while mules or non-descript were kept for draught purposes (11.94%). The study conducted by Himani et al. (2019) showed

most of equine lameness in racing horses (35%), followed by pleasure riding (25%), draft (20%), breeding (15%) and young (5%). The thoroughbred equines presented in the study are kept by BSF, ITBP for patrolling.

Duration wise distribution of equine lameness (Fig. 11): When classified according to the duration of illness (lameness) in equine, it was found that most of the equine were chronically lame, with 35.82% cases presented after more than 30 days of onset of lameness, followed by young equines or fracture cases which were presented within 3 days of illness, 23.88% were presented within 10-30 days of illness period and 11.94% in 3-10 days period. The study conducted by Himani et al. (2019) reported maximum lameness cases presented in 1-3 months of duration (9/20, 45%) indicating the chronic nature of cases that resulted in severity of lesions

Diet wise distribution of equine lameness: The diet of majority of the lameness affected equines was a mixture of green and dry fodder with some cereals (80.59%), followed by milk for all young (16.42%) or a mixture of milk and greens. There were a few equines (n=2) which were kept totally on grain diet and were presented for laminitis and bone fracture. The thoroughbred horses were the best fed with a proper ratio of ingredients as these were kept in established organizations, while the local equines were mostly fed on wheat straw and greens. Dietary factors, particularly the intake of specific plant carbohydrates in fodder, are reported to play a major role in laminitis (Geor, 2009).

Aetiology wise distribution of equine lameness: The initial reason for lameness in equines presented was unknown in maximum number of cases (31.34%), followed by miscellaneous in 29.85%, fall in 16.42%, trauma in 10.45%, congenital in 7.46% and the least due to self-trauma while running or jumping in 4.48%. Sepsis due to injection or trauma in joint leads to septic arthritis in Horses (Honnas et al., 1992).

Distribution of lameness according to region/tissue affected: The total lameness cases in equines (n=67) were classified into bone, joint, soft tissue, hard tissue and spine. The hospital occurrence for equine lameness associated with bone tissue (n=19), joint (n=19) and soft tissue (n=19) was almost equal (28.36% each), followed by hard tissue (n=7) (10.45%) and spinal affections (n=3) (4.48%) (Fig.12). Hoof abnormalities of chronic nature (hard tissue) are highly reported for lameness in equines followed by joints, soft tissue and spinal lesions (Broster et al., 2009; Himani et al., 2019).

Table 4. Distribution of lameness as per region/tissue

Bone affections	Fractures of long and short bones, sesamoids, sesamoiditis, osteitis and laminitis.
Joint affections	Degenerative joint disease, high ring bone, patellar luxation, septic arthritis, dislocation, bone spavin, osteoarthritis and bog spavin.
Soft tissue	Laxity, contracture, side bone fracture, SDF rupture, muscle sprain, Proud flesh, hoof abscess, quitter and tenosynovitis.
Hard tissue	Canker, broken hoof wall, split hoof, thrush and hoof avulsion.
Spinal	Wobbler, Spinal fracture

Specific disease conditions as per age causing equine lameness: Among the young equine of ≤ 1 month of age, fracture of metatarsal or metacarpal, joint involvement due to sepsis or patella luxation and soft tissue involvement due to laxity of joints or contracted tendons were almost equally distributed. Except for fractures and septic arthritis, all remaining animals in this group (≤ 1 month of age) were otherwise congenital and thus were presented in young equines only. The occurrence of fracture in young foal was a part of negligence and was acquired in origin. A foal aged one month had self-inflicted trauma due to passing under an iron railing thus leading to fracture of dorsal spinal process of lumbar vertebrae (Fig. 13). The foal showed signs of hind limb ataxia after 4 days of trauma and on radiography it was diagnosed for fracture of dorsal process of lumbar vertebrae. Firth (1983) reported infectious polyarthritis in foal. Lameness or extended recumbency in newborn foals, accompanied by warm uncomfortable swelling of numerous joints, has been described as "joint ill".

As the age of the equines increased the bone affection started increasing. The equine in one to 6 month of age had 75% bone affections and one had soft tissue involvement. As the activity of equine starts to increase with age, they are vulnerable to bone trauma leading to fractures.

Among the age group of 6-12 months, less equine were presented with one each having bone, soft tissue, joint and spinal affection.

The sub-adult equines of 12-60 month age group had a maximum occurrence of soft tissue involvement (n=7, 38.89%) followed by joint affections (27.78%), hard tissue (hoof wall in 11.11%) and least involvement of spine (in one equine).

Among the adult equine suffering from lameness, majority had joint affections (32.35%) followed by bone (29.41%), soft tissue (23.53%) and hard tissue (14.70%) involvement. Bjornsdottir et al. (2000) reported high occurrence of joint affection in horses in the 6 to 12 years age group.

Among the fractures of bone, the short bones fractures included two cases of sesamoid fracture in a thoroughbred horses (Fig. 14 c & d) due to fall while racing or practicing, fracture of 2nd phalanx in a Nukra female (Fig. 15) with unknown history of trauma, sesamoiditis in a Marwari female (Fig. 14 a & b) with unknown trauma, 11 cases of long bone fractures including humerus (n=2), tibia (n=3), metatarsal or metacarpal (n=6). One of the metacarpal and 2 of the tibia fractures were open at presentation. One young equine aged 5 month had bilateral metacarpal fracture, which died with disease progression as the owner did not opted for euthanasia.

Physical examination findings of the equine presented with lameness

The mean $\pm$ SD values of various physical examination findings such as rectal temperature ($^{\circ}$ F), respiration (/min) and pulse/heart rates (/min) in various groups (as per tissue type involved) have been shown in Table 7.

Table 5: Table showing the mean $\pm$ SD physical parameters as per tissue involvement

Tissue Involved	Temp ($^{\circ}$F)	Pulse (/min)	HR (/min)	RR (/min)
Bone affections	100.45 $\pm$ 1.05	42.12 $\pm$ 4.92 ^{aa}	37.75 $\pm$ 5.03 ^{aa}	17.62 $\pm$ 2.57 ^{aa}
Joint	100.21 $\pm$ 0.80	43.00 $\pm$ 3.95	38.00 $\pm$ 3.75	17.53 $\pm$ 3.18 ^{dd}
Soft tissue	100.44 $\pm$ 0.42	42.78 $\pm$ 3.61 ^{cc}	37.36 $\pm$ 3.58 ^c	18.07 $\pm$ 2.16 ^{cc}
Hoof wall	100.23 $\pm$ 1.21	43.33 $\pm$ 3.14 ^{bb}	38.50 $\pm$ 2.81 ^b	17.50 $\pm$ 4.76
Spine	100.95 $\pm$ 0.35	52.33 $\pm$ 2.88 ^{aabbc}	47.00 $\pm$ 3.46 ^{aabc}	21.00 $\pm$ 0.00 ^{aaccd}
Overall Mean	100.10 $\pm$ 0.98	42.50 $\pm$ 4.95	37.00 $\pm$ 4.24	20.00 $\pm$ 1.41

The same superscript represent the significant difference between two at $p < 0.01\%$ (double superscript) and at $p < 0.05$ (single superscript)

Among all the parameters recorded, the pulse, heart rate and the respiration rate of equines with spinal trauma was significantly more than the other affections involving bone, soft tissue and hoof wall. Al-Derawie (2012) reported increased heart rate, pulse rate and body temperature in acute laminitis cases.

Table 6: Table showing the detail signalment of cases presented with lameness

(TB=thoroughbred, K=Kathiawari, ND=non-descript, BW=body weight, D= Duration of illness, Entangling in rope=EIR, , hit by horse=HBH, wobbler syndrome=WS, LCJ=left carpal joint, HRB=high ring bone, HJ=hock joint, CJ=carpal joint, PF=proud flesh, FD=fetlock dislocation, LOF=laxity of fetlock, soft tissue swelling=STS, RHF=right humerus fracture, BPL=bilateral patellar luxation, RT=right, MT=metatarsal, MC=metacarpal, FF=front fetlock, HL=hind limb, Sw=swelling, P=pastern, G=growth, FL=forelimb, RCRH=right carpal and right hock, HF=humerus fracture, LHP=left hock and pastern, LKH=left knee and hock)

S. No	Breed	Age (month)	Sex	BW (Kg)	Type	Days	Diet	H/O	Diagnosis	Classification of Diagnosis
1	TB	120	Female	390	Racing	365	Mix	Fall	Sesamoid fracture	Bone
2	K	72	Female	325	Breeding	60	Mix	Unknown	Canker	Hoof wall
3	Marwari	1.5	Male	210	Young	1	Milk	EIR	LMT fracture	Bone
4	Nukra	96	Female	200	Breeding	7	Mix	Unknown	Fracture of 2nd phalanx	Bone
5	Marwari	24	Male	337	Racing	12	Mix	Fall	WS	Spine
6	TB	144	Male	430	Racing	60	Mix	Unknown	DJD LCJ	Joint
7	Marwari	66	Female	330	Breeding	7	Mix	Unknown	Sesamoiditis	Bone
8	Marwari	18	Female	291	Breeding	180	Mix	Unknown	DJD CJ and HJ	Joint
9	ND	42	Female	267	Draught	365	Mix	Trauma	HRB and growth	Joint
10	Marwari	3	Female	117	Young	2	Milk	Unknown	Laxity of fetlock	Soft
11	Marwari	0.5	Male	62	Young	0	Milk	Congenital	bilateral patellar luxation	Joint
12	Marwari	0.75	Male	86	Young	0	Milk	Congenital	septic arthritis	Joint
13	Marwari	84	Female	385	Breeding	1	Mix	EIR	Rt humerus #	Bone
14	Marwari	66	Male	327	Racing	45	Mix	AS	side bone #	Soft
15	ND	60	Male	330	Draught	180	Mix	Slip	dislocation	Joint
16	TB	96	Female	343	Racing	2	Mix	ST	broken hoof	Hoof wall
17	ND	42	Female	260	Draught	25	Mix	ST	split hoof	Hoof wall
18	Marwari	7	Female	225	Young	90	Milk	Fall	Humerus #	Bone
19	TB	120	Male	395	Racing	3	Mix	Unknown	laminitis	Bone
20	TB	204	Female	435	Racing	90	Mix	Unknown	DJD HJ	Joint
21	TB	72	Male	423	Racing	30	Mix	HBH	PF	Soft
22	ND	156	Male	320	Racing	7	Mi	No	laminitis	Bone
23	Marwari	30	Female	224	Breeding	1	Mx	Fall	tibia #	Bone
24	ND	36	Male	360	Racing	10	Mix	Unknown	Osteitis MC	Bone
25	Mule	132	Male	284	Draught	10	Mix	Wound	contracture	Soft
26	Nukra	132	Female	360	Breeding	2	Mix	Fall	RMC #	Bone
27	Marwari	144	Female	295	Racing	14	Mix	Unknown	DJD CJ and HJ	Joint
28	TB	84	Male	430	Racing	30	Mix	Unknown	bone spavin	Joint
29	TB	72	Female	419	Racing	20	Mix	Unknown	ring bone	Joint
30	TB	156	Male	430	Racing	30	Mix	Unknown	ring bone	Joint
31	TB	144	Female	426	Racing	15	Mix	Unknown	carpitis	Joint
32	TB	96	Female	410	Racing	150	Mix	Fall	carpitis	Joint

33	Nukra	12	Male	190	Young	3	Mix	Fall	spinal trauma	Spine
34	Ma	120	Female	258	Breeding	1	Mix	Fall	Lt Tibia Open #	Bone
35	Nukra	132	Female	345	Breeding	15	Mix	After shoeing	Thrush	Hoof wall
36	Marwari	0.13	Female	41	Young	0	Milk	Congenital	Contracture HL and FL	Soft
37	Marwari	24	Female	172	Young	10	Mix	Unknown	contacted tendon	Soft
38	Marwari	15	Male	160	Young	1	Mix	Trauma	Hoof avulsion	Hoof wall
39	ND	24	Female	210	Draught	60	Mi	Unknown	PF	Soft
40	Mule	60	Male		Draught	45	Mix	Unknown	Abscess	Soft
41	Nukra	1	Female	65	Young	1	Milk	Fall	RMC O#	Bone
42	Nukra	5	Female	100	Young	7	Milk	Trauma	LMT #	Bone
43	ND	60	Female	389	Draught		Mix	Trauma	FD O	Joint
44	Marwari	30	Male	343	Racing	10	Mix	Spade trauma	partial tear SDF	Soft
45	Nukra	1	Male	40	Young	2	Milk	Trauma	LMT #	Bone
46	Marwari	18	Male	220	Young	30	Mix	Unknown	OCD	Joint
47	Marwari	120	Male	363	Racing	25	Mix	Trauma	Muscle sprain	Soft
48	TB	120	Male	381	Racing	45	Mix	Unknown	Canker	Hoof wall
49	Marwari	120	Female	390	Breeding	4	Grain	Fall	Laminitis	Bone
50	Marwari	5	Female	97	Young	40	Grain	unknown	Bilateral MT #	Bone
51	Nukra	108	Male	423	Racing	30	Mix	Unknown	Side bone	Soft
52	ND	120	Female	319	Breeding	180	Mix	Self- trauma	Osselets	Joint
53	Mule	72	Male	289	Draught	1	Mix	Fall	LFD Open	Joint
54	ND	11	Female	120	Racing	0	Milk	Congenital	LOF	Soft
55	Marwari	30	Female	220	Breeding	1	Mix	Fall	RT # Open	Bone
56	Nukra	18	Female	186	Breeding	12	Mix	Trauma	Contracted T	Soft
57	TB	132	Male	460	Racing	45	Mi	Jump	Ringbone & N Disease	Joint
58	TB	126	Male	456	Racing	7	Mi	Unknown	STS	Soft
59	Nukra	7	Male	120	Young	30	Mix	Unknown	Bilateral bog spavin	Joint
60	ND	72	Male	356	Racing	30	Mix	Unknown	Sidebones	Soft
61	TB	48	Male	389	Racing	60	Mix	Unknown	Quittor	Soft
62	Nukra	144	Female	320	Breeding	365	Mix	Unknown	Broken hoof	Hoof wall
63	ND	30	Female	260	Breeding	90	Mix	Unknown	Contracted tendon	Soft
64	Nukra	0.5	Female	52	Young	0	Milk	Congenital	Laxity of ligaments	Soft
65	Nukra	1	Male	72	Young	15	Milk	Trauma	Spinal #	Spine
66	TB	144	Female	426	Racing	120	Mix		tendinitis and teno- synovitis	Soft
67	TB	120	Female	390	Racing	365	Mix	Unknown	sesamoid fracture	Bone

Lameness analysis based on physical examination and gait analysis

The lameness examination of all the equine included classification of lameness grade as per AAEP grades 1 to 5 depending upon the severity (Table 1).

Among the bone affections, most of the equines had grade 5 lameness, due to fracture (63.16%) followed by grade 2 and 4 (15.79% each). Grade 2 lameness was present in equine with small bones involvement like sesamoids. Grade 5 lameness was in equines with long bone fractures. Grade 3 was observed in osteitis and grade 4 in laminitis. Garner et al. (1975) reported grade 3 lameness in most of the equines.

For joint affections, maximum equines had grade 3' lameness (31.58%) while grade 2, 4 and 5 were almost equally divided. The equines with dislocation or patellar luxation had grade 5' lameness while with DJD or arthritis has mild lameness of grade 2, 3 and 4, respectively.

Among soft tissue lameness, the maximum equine had grade 4 lameness (42.10%) and the minimum had grade 3 (10.01%). The grade 5 lameness was in equine with contracted tendon or tendon rupture, while grade 4 in with joint laxity. Other affections of muscle sprain had low grade lameness.

For hoof wall affections grade 2 and 4 were equally divided (42.86%). Thrush and canker like affections had grade 2' lameness while hoof wall split or broken hoof or avulsed hoof had grade 4' lameness.

Among spinal trauma equines, one was presented recumbent (grade 5) while 2 had ataxia of hind legs (grade 3).

Lameness as per gait

As per gait of the equine maximum equines with bone involvement had lameness apparent during walk itself due to fractures. While those with joint affections, showed lameness at walk and trot equally. The maximum equines with soft tissue affections also showed lameness at walk itself, especially for equine with contractures or tendon rupture.

For hoof wall affections, most of the equine showed lameness at walk (for those with hoof split or broken), while for those with canker and thrush showed lameness at trot.

Among spinal trauma equines, 2 had lameness on walk while one was presented recumbent.

Table 7: Table showing the lameness scores for different tissue involvement

Parameter	Tissue Type affected	Lameness grade	No	Per cent
Grade of lameness	Bone (n=19)	2	3	15.79
		3	1	5.26
		4	3	15.79
		5	12	63.16
	Joint (n=19)	2	5	26.31
		3	6	31.58
		4	4	21.05
		5	4	21.05
	Soft tissue (n=19)	2	4	21.05
		3	2	10.53
		4	8	42.10
		5	5	26.31
	Hard tissue (n=7)	2	3	42.86
		3	0	0
		4	3	42.86
		5	1	14.28
	Spine (n=3)	2	0	0
		3	2	66.67
		4	0	0
		5	1	33.33
Lameness at gait	Bone (n=19)	Walk	13	68.42
		Trot	3	15.79
		Recumbent	3	15.79
	Joint (n=19)	Walk	9	47.37
		Trot	9	47.37
		Recumbent	1	5.26
	Soft tissue (n=19)	Walk	14	73.68
		Trot	5	26.31
		Recumbent	0	0
	Hard tissue (n=7)	Walk	4	57.14
		Trot	3	42.86
		Recumbent	0	0
	Spine (n=3)	Walk	2	66.67
		Trot	0	0
		Recumbent	1	33.33

Nerve blocks:

The nerve block was applied in 5 equines, while others treated surgically, were under general anaesthesia or sedation. The outcome was classified as full, partial and no effect. The effect of high 4 point was due to chronic nature and severity of affection of fetlock arthritis. The effect of low 4 point was partial due to chronic contracture and fetlock bearing weight on the affected limb. Lopez-Sanroman et al. (2003) described that the no effect of nerve blocks may be due to inadequate dosage, incorrect deposition or aberrant nerve supplies. Himani et al. (2019) also stated lower (66.7%) efficacy of nerve / joint blocks in confirming the lameness lesions in equines.

Table 8: Details of nerve block(s) used and their effect

Condition	Nerve block	Effect	Remarks/Justification
Canker	Palmar digital	Full	Growth resected under block only
Broken hoof with granulation	Palmar digital	Full	Lameness did not appear after block.
Osselets	High 4 point	Partial	Chronicity and severity of affection.
Pastern contracture	Low 4 point	Partial	Angulation was severe.
Hind fetlock swelling	Low 4 point	No effect	Inadequate dosage, animal improperly restrained.

Neurological exam:

Among the neurological exam conducted, only 3 equines showed it positive, 2 with spinal trauma and hind limb ataxia, and one with muscle sprain showed swinging.

Radiographic occurrence of single versus multiple lesions causing lameness in equines:

In the current study out of 67, 59 lame horses were subjected to radiographic examination and were detected with 78 lesions involving same or different limbs. Radiography alone detected 54 lesions in 43 horses while the remaining 13 cases had soft tissue lesions in which radiography ruled out bone and joint involvement. Out of 43, most cases of equine lameness (74.42%, n=32) had single radiographic lesion, whereas the remaining (25.58%, n=11) had multiple lesions involving one limb (6.98%, n=3) or more than one limb (18.60%, n=8) (Table 9, Fig. 16). The earlier

study on the clinical occurrence of equine lameness conducted by Himani et al. (2019) also reported similar trend and concluded the high prevalence of multiple lesions involving one or more limbs as serious diagnostic challenge.

Table 9: Radiographic lesions/limb affected according to single versus multiple lesions (Fig. 16)

Number of Lesions	Single lesion	Multiple lesion (same limb)	Multiple lesion (different limb / spine)
No. of cases (n=43)	32 (74.42%)	3 (6.98%)	8 (18.60%)

Occurrence of lameness with regard to relative frequency of fore and hind limb

The study showed that majority of lameness cases, arising from joint affections, was from forelimbs (n=21; 56.75%) as compared to hind limb (n=16; 43.25%). Out of all four limbs, right forelimb was most frequently affected (n=13; 35.14%), followed by right hind limb (n=10; 27.03%), left forelimb (n=8; 21.62%) and least the left hind limb (n=6; 16.22%) (Fig. 17). Right forelimb lameness is reported maximum in equine (Dabareiner et al., 2005; Mohsina et al., 2014) followed by the left forelimb, the left hind limb and the right hind limb.

Based on radiographic occurrence (Table 10), the coffin joint of forelimbs was most frequently affected (27.03%) followed by hind limb fetlock joint (18.92%), Tarsal (16.22%) and carpal joint (13.51%). Halder (2006) reported the knee joint (42.55%) and meta-tarso-phalangeal (29.79%) joints to be most affected in equine lameness.

Table 10: Distribution of lameness involving joints of forelimbs and hind limbs (Fig. 18)

Limb	Joint	Number	Per cent	Limb affected			
				Right		Left	
Fore limb (n=21; 56.75%)	Coffin	10	27.03	7	(n=13; 35.14%)	3	(n=8; 21.62%)
	Pastern	4	10.81	3		1	
	Fetlock	1	2.70	0		1	
	Carpal	5	13.51	3		2	
	Elbow	1	2.70	0		1	
Hind limb (n=16; 43.25%)	Coffin	0	0	0	(n=10; 27.03%)	0	(n=6; 16.22%)
	Pastern	0	0	0		0	
	Fetlock	7	18.92	4		3	
	Tarsal	6	16.22	4		2	
	Stifle	3	8.11	2		1	
Total		37	100	23		14	

Radiographic occurrence of bone lesions: A total of 17 cases of long and short bones were presented, which included fractures of metatarsal bone the most (n=6) which also included a bilateral metatarsal bone (Fig. 19), tibia (n=3), humerus (n=2) and metacarpal (n=2) (Fig. 20). The hoof wall with fracture or dislocation (Fig. 21) was found involved in 4 equines. There was side bone, sesamoid fracture in one equine (Fig. 14) each and phalanx fracture in 2 cases each (Fig. 15). There was open dislocation of fetlock joint in 2 equines. Verschooten et al. (1984) recorded high prevalence of splint bone fracture in thoracic limb (n=31) in relation to pelvic limb (n=13).

Joint Affections: Apart from the fractures, osteophytes leading to arthritic changes in various joints were seen in 25 equines. The maximum affected were the hock, knee and pastern joint.

Coffin joint (Fig. 21): In this study, a total of 10 cases of lameness with coffin joint affection were presented. The coffin joint of right forelimb was most commonly affected. Seven cases of right forelimb and 3 cases of left forelimb were reported which constitute 27.03% of total joint affections. Most of cases were of side-bones and that too of chronic nature. The other cases of coffin joint affection were chronic laminitis, low ring bone and fractures side bone, navicular disease.

Pastern joint (Fig 22): A total of 4 cases of forelimb pastern were recorded which constituted 10.81% of total joints affection. The affections of this joint were high ring bone, non-displaced fracture [favourable prognosis]. The occurrence of high ring bone was more among pastern joint affections. Semieka and Ali (2012) also stated ringbone to be the major cause affecting foot of donkeys, and concluded it to be more common in the fore limbs than hind limbs.

Fetlock joint (Fig. 23): A total of 8 cases of fetlock joint affections were detected out of which 1(2.70%) was of forelimb and 7(18.92%) were of hind limb. The affections of this joint included; osselets (severe reaction), compound dislocation, mild periosteal reaction and sesamoiditis.

Carpal/knee joint (Fig. 24): In the present study, a total of 5 cases of knee joint affections were reported that constituted 13.51% of total joint affections. It was the 2nd most common joint affected in forelimb after coffin joint. The affections were

severe arthritis involving periosteal reaction of all carpal bones. Osteo-arthritis is the most commonly reported affection of carpal joint (Dabareiner et al., 2005).

Tarsus/hock joint (Fig. 25): In this study, a total of 6 cases were recorded of hock region which comprises of 16.22 per cent of the total affections of joint. Tarsus joint was the 2nd most affected joint in hind limb after fetlock. The affections of hock joint with maximum occurrence were bone spavin of chronic nature. Other affections recorded were DJD of tibiotarsal joint. Degenerative joint disease of hock is the most commonly reported affection (Barcelos et al, 2016).

Elbow joint: A single case of OCD was reported in the elbow which comprised 2.70% of total joint affections. The prognosis of case was good and was treated medicinally.

Stifle joint (Fig. 26): Three cases of stifle region were recorded which constituted 8.11% of total joint affections. The affections were patellar luxation which were treated surgically and responded fairly well and another case of severe septic arthritis.

Lameness due to contracted tendon, laxity of tendon, proud flesh, laminitis, SDF tear, hoof abscess, tenosynovitis did not show any bony abnormality on radiograph. One equine with laminitis showed rotation of 3rd phalanx.

Bilateral lateral luxation of patella was recorded in one foal of 25 days of age. A Marwari foal of 15 days was presented with non-weight bearing on hind limb since birth. A lameness grade of 5 was noted and animal were able to stand only for short duration after support. On radiography, AP and lateral view of both stifle revealed luxation of patella laterally.

Radiography of lumbar spine was not possible in two equines with spinal problem. One case of Marwari male horse of age 10yr used for racing was presented for lameness of hind limbs since 1 month with the history of falling. On physical examination grade 2 lameness was evident and pelvic rise on both limbs was observed. Animal showed pain on palpation of lumbar area. Radiography of that region was not possible. Another case of a 1yr old male nukra-marwari was presented recumbent and had the history of spinal trauma. Pain was evident in last 3 thoracic vertebrae. The owner was not willing for euthanasia so the equine were kept on analgesic and nerve tonic.

Table 11: Disease condition and location wise break up of lesions

Disease condition	Location	No. of lesions
Fracture (n=21)	Humerus	2
	Tibia	3
	Metatarsal	6
	Metacarpal	2
	Sesamoid	1
	Phalanx	1
	Side bones	1
	2nd phalanx	1
	Hoof wall	4
Dislocation (n=2)	Fetlock	2
Osteophytes /Bone reaction (n=29)	Hock joint	5
	Knee	5
	Sesamoid	2
	Pastern	5
	Stifle (patella)	1
	Metacarpal	1
	3rd phalanx	1
	2nd phalanx	1
	OCD	1
	Side bones	7
NAD for bone (n=4)	Hoof	4
Soft tissue involvement (n=17)	Laxity of fetlock	3
	Proud flesh	2
	Laminitis	2
	Contracted tendon	5
	Hoof Abscess	1
	SDF tear	1
	Soft tissue	2
	Tenosynovitis	1
Patellar luxation (n=1)	Bilateral	1
Rotation of 3rd phalanx (n=1)		1
Spine (3)		3

Table 12: Table showing the radiography findings of equines with lameness

S.	Breed	X-ray finding	Diagnosis
1	Thoroughbred	Fracture of proximal axial sesamoid	Sesamoid fracture
2	Kathiawari	Soft tissue density at palmar aspect of hoof	Canker
3	Marwari	Fracture of MT	MT fract.
4	Nukra	Multiple cracks in 2 nd phalanx	Cracks on 2 nd phal.
5	Marwari	Periosteal reaction at talus and osteophytes	Wobbler
6	Thoroughbred	Severe periosteal reaction on all carpal bones	DJD of knee
7	Marwari	Periosteal reaction at medial of proximal sesamoid	Sesamoiditis
8	Marwari	Periosteal reaction of knee and hock joint	DJD of knee and hock
9	Nondescript	Periosteal reaction at pastern and osteophytes	High ring bone, growth
10	Marwari	NAD	LOF
11	Marwari	Both Patella luxated laterally	BPL
12	Marwari	Osteolysis of patella	Septic arthritis
13	Marwari	No	Right Humerus Fracture
14	Marwari	Ossified collateral cartilage	Fracture of side bone
15	Nondescript	Proximal fracture of 2 nd phalanx	Dislocation of pastern
16	Thoroughbred	Deformed hoof wall	Broken hoof
17	Nondescript	No	Split hoof
18	Marwari	Fracture of humerus	Humerus fracture
19	Thoroughbred	Bilateral rotation of 3 rd phalanx and sinking of phalanx	Chronic laminitis
20	Thoroughbred	Mild periosteal reaction at hock	Bone spavin
21	Thoroughbred	No	Proud flesh
22	Nondescript	No	Laminitis
23	Marwari	Tibia fracture	Tibia fracture
24	Nondescript	Periosteal reaction at dorsal aspect of MC	Periosteal reaction at RT MC
25	Mule	No	Contracture
26	Nukra	Fracture of RMT	RMC
27	Marwari	Periosteal reaction of knee and hock	DJD of knee and hock
28	Thoroughbred	Periosteal reaction at distal inter-tarsal and tarso-metatarsal joint	Bone spavin
29	Thoroughbred	Periosteal reaction at pastern joint	Ring bone
30	Thoroughbred	Periosteal reaction at pastern joint	Ring bone
31	Thoroughbred	DJD of knee	Carpitis

32	Thoroughbred	DJD of knee	Carpitis
33	Nukra	Not done	Spinal trauma
34	Marwari	Left tibia fracture	Left tibia fracture
35	Nukra	Mild periosteal reaction at dorsal aspect of 3 rd phalanx	Thrush
36	Marwari	NAD	Contracture
37	Marwari	NAD	Contracted tendon
38	Marwari	Deformed hoof wall	Hoof avulsion
39	Nondescript	NAD	Mass at fetlock
40	Mule	NAD	Abscess
41	Nukra	RMC fracture	RMC fracture
42	Nukra	Salter harris type 2 fracture of MT	LMT fracture
43	Nondescript	Compound Fetlock dislocation	Fetlock dislocation
44	Marwari	NAD	Partial SDF tear
45	Nukra	LMT fracture	LMT fracture
46	Marwari	OCD of lateral humerus condyle	Suspected OCD
47	Marwari	Not done	Back pain
48	Thoroughbred	NAD	Canker
49	Marwari	NAD	Laminitis
50	Marwari	Fracture MT	Both MT fracture
51	Nukra	Ossification of collateral cartilage	Side bone
52	Nondescript	Periosteal reaction, osteophytes at fetlock joint	Osselets
53	Mule	Fetlock dislocation	Fetlock dislocation
54	Nondescript	No	LOF
55	Marwari	Fracture of right tibia	R Tibia fracture
56	Nukra	NAD	Contracted tendon
57	Thoroughbred	Periosteal reaction at pastern and navicular bone	Ringbone and navicular dis.
58	Thoroughbred	NAD	Soft tissue swelling
59	Nukra	NAD	Bog spavin
60	Nondescript	Ossification of collateral cartilage	Side bones
61	Thoroughbred	Osteomyelitis of 2 nd phalanx	Quitter
62	Nukra	Deformed hoof	Broken hoof and granulation
63	Nondescript	NAD	Contracted tendon
64	Nukra	NAD	LOF
65	Thoroughbred	Increased Soft tissue density at palmar aspect of fetlock	Tenosynovitis and tendinitis
66	Nukra	Fracture of dorsal spine of lumbar 2 vertebrae	Spinal #
67	Thoroughbred	Reaction at proximal sesamoid bone	Sesamoiditis

ULTRASONOGRAPHY OF EQUINES WITH LAMENESS:

Ultrasonography was performed in 5 equines, presented with soft tissue involvement for lameness with or without bone / joint lesion.

Congenital defect of Laxity of fetlock: The ultrasonography of this foal was otherwise normal, with no change in echogenicity of tendons along fetlock, no hematoma or tear in the tendon (Fig. 27).

Ring Bone: The thoroughbred equine was presented with grade 2' lameness at trot. There was swelling in fore fetlock region. The ultrasonography revealed, fluid in the tendon sheath, however, no change in echogenicity of the tendon or change in thickness was observed (Fig. 28)

Carpitis: The female thoroughbred equine aged 12 years was presented with swelling in knee and grade 3' lameness on trot. On USG fluid in the tendon sheath was seen (Fig. 29). No other change in echogenicity was recorded. On radiography, periosteal reaction was visible in carpal bones.

Laminitis and swelling: A 10 year old Marwari mare was presented with swelling on the elbow region and grade 4' lameness on walk with laminitis. Ultrasonography of the left elbow and shoulder region revealed a hypoechoic density in the shoulder region (Fig. 30).

Tenosynovitis (Fig. 31): A 12 year's old Thoroughbred mare was presented with grade 3 lameness on trot and swelling in the right hind metatarsal and fetlock region. Radiography revealed mild ossification of DDFT at the level of proximal sesamoid. On ultrasonography, deep digital flexor tendon was hyper echoic at the level of proximal sesamoid and anechoic fluid was seen in the tendon sheath.

Table 13: Table showing medicinal treatment and outcome

S.	Breed	age	Sex	Diagnosis	Treatment (conservative/surgical)	Prognosis	Follow UP	Final Outcome	Complications if any
1	TB	120	F	Sesamoid fracture	Stall rest (6wks), tab serrakind, crepe bandaging	Good	No lameness, callus present	Excellent	No
2	NM	96	F	Cracks on 2 nd phalanx	Stall rest 6wks, Farrier formula		No follow up		
3	Ma	24	M	Wobbler	Inj neurokind ,farrier formula for 1 month	Good	No ataxia	Excellent	No
4	Ma	66	F	Sesamoiditis	Inj megludyne,cold fomentation		No follow up		
5	Ma	0.75	M	Septic arthritis	Inj taxim, inj mecovet, tab glucosamine	Poor	Died	Poor	
6	TB	204	F	Bone spavin	Tab cartigen, farrier formula	Fair		Fair	Wound at pastern
7	TB	72	M	Proud flesh	Inj ac vet, inj melonex	Poor	Died	Poor	Systemic disease
8	ND	156	M	Laminitis	Phenylbutazone, farrier formula		No follow up		
9	ND	36	M	Reaction at RMC	Cold fomentation and creepe bandaging, inj acvet, inj melonex		No follow up		
10	Ma	144	F	DJD of knee n hock	Farrier formula, tab cartigen 3 tab/1month	Poor	No follow up		
11	ND	24	F	Proud flesh	Inj piperacillin Tazo ,mgso4 dressing	Poor	No improvement	poor	
12	Ma	18	M	OCD	Farrier formula, equimin	Good	significant improvement	Good	no
13	Ma	120	M	Back pain	Tab evion, inj neurokind,stall rest,massage	Good	improvement	Excellent	Pain while bending neck
14	Ma	120	F	Laminitis	Tab serrakind, inj neurokind	Poor	No follow up		
15	TB	126	M	Soft tissue swelling	Hot fomentation ,creepe bandaging, inj flunixin	Good	Improvement	Excellent	
16	NM	7	M	Bog spavin	Creepe bandaging, stall rest	Good	Improvement	Excellent	
17	ND	30	F	Cont.tendon	Tab serrakind	Poor	No Improvement	poor	Maggot wd
18	ND	1	M	Lumbar #	Inj. Prednisolone, mecovet, rantac	poor	No follow up		
19	TB	144	F	Tenosynovitis	Stall rest, creepe, inj flunixin	Good	Improvement	Good	
20	TB	120	F	Sesamoiditis	Inj flunixin, tab seerakind	Good	Improvement	Good	

Table 14: Table showing no. of culled/condemned cases

S.	Breed	age	Sex	Diagnosis	Treatment (conservative/surgical)	Prognosis	Follow UP	Final Outcome	Complications if any
1	TB	144	M	DJD of knee	Farrier formula, tab cartigen	Poor	No follow up		
2	Ma	18	F	DJD of knee and hock	Inj intaceftazo 4.5gm bid/5days, inj flunixin10ml/3days	Poor	No follow up		
3	Ma	66	M	Side bone #	Stall rest for 1month, farrier formula	Poor	No improvement	Poor	Rotation of 3 rd phalanx
4	ND	60	M	Dislocation of pastern	Tab cartigen, tab serrakind	Poor	No improvement	Poor	No
5	ND	42	F	Split hoof	mgso4 dressing. Maggot wd mangt	Poor	No improvement	Poor	Maggot wd
6	Ma	7	F	Humerus #	Inj mecovet, oil massaging	Poor	Animal sold	Poor	-
7	TB	120	M	Chronic laminitis	Intacef tazo, inj megluyne	Poor	no follow up		
8	mule	132	M	Contracture	Inj mecovet, inj. melonex		No follow up		
9	TB	84	M	Bone spavin	Stall rest, tab serrakind, tab cartigen	Poor	No follow up		
10	TB	72	F	Ring bone	Farrier formula, tab cartigen	Poor	No follow up		
11	TB	156	M	Ring bone	Farrier formula, tab cartigen	Poor	No follow up		
12	TB	144	F	Carpitis	Tab cartigen, tab serrakind	Poor	No follow up		
13	TB	96	F	Carpitis	Tab cartigen, tab serrakind	Poor	No follow up		
14	NM	12	M	Spinal trauma	Inj prednisolone, inj mecoevet	Poor	No follow up		
15	NM	108	M	Sidebone	Stall rest, farrier formula, tab cartigen	Poor	No follow up		
16	ND	120	F	Osselets	Inj phenylbutazone	Poor	No follow up		
17	TB	132	M	Ringbone and ND	Farrier formula, stall rest	Poor	No follow up		
18	ND	72	M	Sidebones	Farrier formula, tab cartigen	Poor	No follow up		
19	TB	48	M	Quitter	Intacef tazo, inj flunixin	poor	No follow up		
20	Ma	30	F	Old Tibia fracture Closed	Inj neurokind, inj melonex	Poor	No improvement	Poor	still lame

Table 15: Table showing cases treated surgically and their outcome

S.	Breed	age	Sex	Diagnosis	Treatment (conservative/surgical)	Prognosis	Follow UP	Final Outcome	Complications if any
1	K	72	F	Canker	Growth removed under GA, ZIPP, Antibiotic and pain killers	Good	No growth, no lameness	Excellent	
2	Ma	1	M	MT fracture	Fibre cast, Antibiotic and painkiller	Fair	Callus present	Excellent	
3	ND	42	F	High ring bone, growth	Mass resected under GA, Antibiotic and pain killers	Good	Wound healed properly, animal still lame	Excellent	no
4	Ma	0.5	M	BPL	Wedge trochleoplasty both patella, Grade 4	Fair	Moderate improvement	Fair	
5	TB	96	F	Broken hoof	Trimming and debridement under GA, KMNO4 flushing	Good	Moderate improvement	Fair	maggot
6	NM	132	F	MC #	Fibre glass with caudal splint, Antibiotic and painkiller	Good	No follow up		
7	NM	132	F	Thrush	Curettage, formalin foot bath	Good	No follow up		
8	Ma	0.13	F	Contracture both hind one fore	Tenotomy under LA, pop applied with caudal splint, Antibiotic and painkiller	Fair	Right forelimb contracture persist	Fair	Limping at forelimb
9	Ma	24	F	Cont.tendon	Tenotomy under GA, fibre glass applied, Antibiotic and painkiller	Good	NO follow up		
10	Ma	15	M	Hoof avulsion	Hoof attachments removed under GA. And advised shoe application with ZIPP. Antibiotic and painkiller	Fair	No follow up		
11	Mule	60	M	Abcess	Drainage using needle, Antibiotic and painkiller	Good	recovered	Excellent	
12	NM	1	F	RMC fracture	Fibre glass, Antibiotic and painkiller	Good	No follow up		
13	NM	5	F	LMT fracture	Fiberglass applied with splints and window after cutting the exposed bone with wire saw. Antibiotic and painkiller	Guarded	Wound healed wt bearing present	Good	Osteomyelitis.
14	ND	60	F	Fetlock dislocation	Fiberglass applied with window, Antibiotic and painkiller	Guarded	No follow up		

15	Ma	30	M	Partial sdf tear	Debridement and suturing under GA, Antibiotic and painkiller	Fair	Granulation tissue formed	Fair	Mild wt bearing, bleeding
16	NM	1	M	LMT fracture	Fibre glass applied, Antibiotic and painkiller	Good	No follow up		
17	TB	120	M	Canker	Mass resected under LA, Antibiotic and painkiller	Good	No lameness	Excellent	no
18	Mule	72	M	Fetlock dislocation	Joint repositioning done under GA, FIBRE CAST, Antibiotic and painkiller	Fair	Granulation tissue. mild weight bearing	Good	limping
19	NM	18	F	Cont.tendon	Fibre cast applied, Antibiotic and painkiller	Good	Animal bearing well	Good	
20	NM	144	F	Broken hoof & granulation	Tissue removed under GA, zipp, Antibiotic and painkiller	good	Sig improvement	Good	
21	ND	11	F	LOF	Creepe bandaging,tab cartigen	Fair	Mild improvement	fair	
22	Ma	3	M	LOF	Creepe bandaging,exercise,	poor	No improvement	poor	
23	NM	0.5	F	LOF	Splint applied at both hind limb, zipp, Antibiotic and painkiller	good	Sig. improvement	good	Wound

Table 16: Table showing Equine euthanized due to poor prognosis on the consents of owner

S.	Breed	age	Sex	Diagnosis	Treatment (conservative/surgical)	Prognosis	Final Outcome
1	Ma	84	F	RHF	Euthanized	Poor	euthanized
2	Ma	120	F	Tibia fracture	Euthanized	Poor	euthanized
3	Ma	30	F	Tibia fracture	Euthanized	Poor	euthanized

Table 17: Table showing equine recommended for euthanasia but owner did not gave consents

S.	Breed	age	Sex	Diagnosis	Treatment (conservative/surgical)	Prognosis	Follow UP	Final Outcome	Complications if any
1	Ma	5	F	Both MT fracture old	Advised euthanasia Poor prognosis	Poor	Animal recumbent	Died	Pain, recumbency, anorexia

Medicinal treatment of lame equines

1. **Bog spavin (n=1):** A 7 month old foal was presented with bilateral bog spavin since 30 days and having lameness of grade 2. On physical examination, painless swelling on medial aspects of either hock was noted. The owner was advised to keep the animal at rest for 3 weeks and prescribed inj. flinixin 4 ml (1.1 mg/kg) i.v for 3 days with pressure bandaging on both hock for 1 week. The outcome was good with resolution of lameness after 1 month. Dar et al. (2016) treated the case of bog spavin successfully by needle aspiration of fluid, pressure bandaging and phenylbutazone inj for 3 days.
2. **Wobbler syndrome (n=1):** A Marwari male horse of 2 yr used for racing was presented for in-coordination in both hind limbs since 12 days. On physical examination lameness grade 3 was observed on both hind limbs and sway test was positive. Radiography reveals no apparent abnormality in cervical spine but reaction was present at left tallus bone. The owner was advised to stall rest the animal for 3 weeks, farrier formula supplementation for 1 month and nerve tonic for 1wk were prescribed. The ataxia abolished in 2 weeks' time. Multiple reasons for wobbler syndrome are reported in literature; physical trauma, rapid growth, genetic cause, nutritional imbalances, and the combination of above (Larson, 2011). Aggressive nutritional management and well-controlled exercise with early diagnosis is also found to be beneficial in the treatment of a “wobblers” (Larson, 2011).
3. **Spinal trauma / Back pain (n=3):** A Marwari, male horse of age 10yr used for racing was presented for lameness of hind limbs since 1 month with a history of fall. On physical examination grade 2 lameness was evident with pelvic rise in both limbs. On palpation of lumbar area animal showed pain. Radiography was the limitation in that area. The animal was treated with Vitamin E supplement, stall rest for 6wks, massaging with warm oil twice for 3 weeks. The animal responded well.

Another case of 1yr old male nukra-marwari was presented with the history of spinal trauma and was recumbent. The radiograph was again a limitation. Pain was felt in last 3 thoracic vertebrae. The owner was not willing for

euthanasia so animal was kept on analgesic and nerve tonic. The prognosis of case was poor. Box rest and physiotherapy has been advised in such cases (Haussler, 1997).

4. ***Chronic laminitis (n=1):*** A thoroughbred male of age 10yr and used for racing was presented with lameness in both forelimbs since 3 days. On physical examination, lameness grade 4 was recorded and no abnormality of hooves was found. Radiography revealed rotation of 3rd phalanx ($> 11.5^\circ$), so prognosis was guarded. The equine was advised stall rest for 4weeks on soft bedding with re-shoeing. Therapeutic shoeing has the ability to prevent additional injury, reduce pain, and promote healthy new hoof wall development (Parks & Grady, 2003)
5. ***Osteochondritis dessicans:*** A Marwari male of 1.5yr was presented with lameness grade of 2 on left forelimb. On physical examination no swelling or pain was noted. On radiography, lateral condyle of humerus showed a lytic lesion. The equine was advised rest for 2 months and supplements were given like equimin (50g) for 2 months and farrier formula for 2 months. The animal showed improvement after 2 months.
6. ***Tenosynovitis:*** A thoroughbred mare of 7yr was presented with the swelling of distal left hind limb since 2 month and showed lameness grade 3. On palpation, the swelling was soft and radiography of affected site shows calcification of DDFT at the site of proximal sesamoid bone. On USG, anechoic fluid was present in the tendon sheath with no thickening of tendons but mild calcification of DDFT. The equine was advised stall rest for 1 month with crepe bandaging over the affected area. Analgesics were recommended for 3 days. The follow up after 14 days reveal marked reduction in swelling and decrease in lameness.

Surgical treatment of lame equines

The details of surgical methods used to treat various surgical conditions:

1. ***Canker (n=2) (Fig. 32):*** The horses suffering from canker were treated surgically. First horse was operated under general anaesthesia (Oosterlinck, 2015) while second under palmar digital nerve block. The growth was removed under general anaesthesia in one horse and under local nerve block in another. After procedure,

the hooves of both horses were dressed with ZIPP dressing and antibiotic and NSAIDs were given.

2. ***Bilateral Patellar Luxation (n=1) (Fig. 33):*** Each luxated patella was operated at a gap of 2 weeks. The foal was fasted for 6 hours so as to prevent hypoglycemia and dehydration. The foal was administered general anesthesia using xylazine and ketamine and maintained on isoflurane. The standard surgical (cranio-lateral para patellar) approach was followed to expose the stifle joint. The shallow trochlear groove was deepened by wedge recession trochleoplasty. A medial release incision was required to make the patella position at the trochlear groove. Lateral imbrication using silk was also done. The joint capsule and tensor fascia lata were sutured with vicryl no. 0 using simple interrupted suture pattern. Skin incision was closed with silk using cross mattress suture pattern. After two weeks, the same procedure was repeated on the other stifle joint using similar protocol. Postoperative medication included antibiotics and analgesics for 5 and 3 days, respectively along with daily antiseptic dressing. Suture removal was advised after 12 days of surgery. The follow up at 1.5 month revealed moderate improvement with weight bearing on both hind limbs.
3. ***Broken hoof with granulation (n-1) (Fig. 34):*** The equine was fasted for 12 hrs before surgery. General anesthesia was given and the granulation tissue was removed and wound was packed with cotton bandage impregnated with ZIPP ointment. The affected hoof was covered with bandage and medications were given routinely.
4. ***Partial SDF tear (n=1) (Fig. 35):*** A Marwari male horse of age 5yr was presented with partial tear of SDF of the right hindlimb. The equine showed grade 5 lameness (non-weight bearing). Under general anaesthesia, the wound was properly debrided and the torn ligament was sutured using Bunell Mayer suture pattern using polyester suture. The limb was properly bandaged and splint was applied at the caudal aspect. The owner was advised proper dressing of wound with ZIPP. The animal was again presented to clinic after 14 days with formation of granulation tissue at the affected site and a little improvement in weight bearing. The equine was advised daily dressing with copper sulphate and

magnesium sulphate after hydro-therapy. The follow up at 2 months revealed mild granulation tissue with improved weight bearing.

5. ***Contracted flexor tendons (n=5) (Fig. 36):*** Foals (very young and sub-adult foals) were presented with the contracture of fetlock of either hind limb or forelimbs. The foals were casted in lateral recumbency and after proper preparation of surgical site, mid metacarpal and SDF is incised. In few cases, pressure applied with caudal splint served the purpose and tenotomy was not required. The leg was properly extended and flexed to tear off the remaining fibers of tendon and then POP cast was applied which was changed at weekly intervals.

Contracted tendon in 1.5 year old mare: A Nukra-marwari filly was presented with the contracture of right fore- fetlock since 10 days. The fibre glass cast was applied on the affected limb after proper extension. The telephonic follow up revealed complete recovery. Owen (1975) stated that Vitamin and mineral therapy, splinting the leg using plaster cast, corrective shoeing, and sectioning of the deep digital flexor can be used for the treatment of contracted tendon.

6. ***Compound fetlock dislocation (n=2) (Fig. 37):*** The mule was presented with condition and under G.A., after proper preparation of surgical site, the protruded metacarpal was repositioned back into proper alignment and wound sutured. The fiber cast with caudal aluminium splint was applied and window kept at wound for daily ASD dressing. Other medication included antibiotics, analgesics and daily antiseptic dressing with ZIPP (Zinc sulfate and Iodoform (2:1) solution in liq. Paraffin). The follow reported good weight bearing on limb and properly healed wound.
7. ***Fractures (n=5 (Fig. 38):*** Open and closed fractures of various bones like humerus, tibia and metatarsal were presented. fracture of left metatarsal since 1 day. The radiographs were done. For distal limb fractures, the equines were treated using fiberglass cast and splints, while the proximal fractures of long bones were either presented late or were not treated. Open fractures were treated and advised euthanasia but in few cases where owner did not comply with euthanasia, the cast was applied with window or bandaging was done.

8. ***Laxity of ligaments/Hyperextension deformities (n=3) (Fig. 39):*** Three foals were presented with hyperextension of one or all fetlocks since birth. Grade of lameness was evaluated and radiographs were done to rule out any fracture. The foals were treated using either crepe bandage alone or heavy bandaging with caudal splints applied and were advised to mild exercise. A young nukra foal was presented with hyperextension of all fetlocks since birth. On physical examination, lameness grade 4 was evident and wound at lateral side of both hind fetlock and right hock at caudal aspect. On the X-ray, bone reaction in the right hock joint was evident. The animal was treated with broad spectrum antibiotics and caudal splint applied on both caudal aspect of hind limb with heavy dressing and advised to mild exercise the animal. The follow up was good with no hyperextension evident after 15days.

Another case of a 3 month foal of Marwari breed was presented with laxity of ligaments of left forelimb by birth. The limb was applied with crepe bandage for 15 days and mild exercise was recommended. The 2 weeks follow up reported no significant improvement which later progressed to wound formation on the dorsal aspect of fetlock. Mild cases of laxity respond well to moderate exercise and trimming of heel (Emberston, 1994).

9. ***Growth at fetlock joint (n=1) (Fig. 40):*** A non-descript mare of 3.5yr was presented for lameness and growth since 1 yr with lameness grade of 4. On palpation, the growth was hard and non-movable. Anterio-posterior and lateral view of distal limb reveal periosteal reaction of pastern joint. The growth was resected under GA and proper bandaging of wound done. Follow up at 1 month revealed no growth with properly healed wound and improvement in lameness.
10. ***Broken hoof (n=1):*** A thoroughbred mare of 8yr age was presented with left hind hoof broken since 2 days with maggot infestation. The animal showed lameness of 4 grade. The animal was given general anesthesia and all maggots were removed and proper debridement of hoof with trimming of broken part done. The hoof was dressed with ZIPP and advised dressing for 2 weeks and to keep animal on dry area. Antibiotics and analgesic were prescribed. The follow up revealed proper wound healing with no lameness.

11. **Thrush (n=1):** The equine was treated by curetting the wound and washing with KMnO₄ solution. Analgesics were given.
12. **Septic arthritis of stifle joint (n=1):** A Marwari foal of age 21days was presented with the history of wound on the right stifle since birth. On physical examination, pus was observed in the wound and animal showed grade 3 lameness. On lateral radio-graph of right stifle, osteolysis of patella was seen. Flushing of wound was done with normal saline solution. Broad spectrum antibiotics were advised for 10days and rest for 3 weeks. The foal died within 3 days of treatment. A high dose of antibiotic therapy for long term is advised in such cases with sufficient amounts and concentrations of Colostrum (Firth, 1983) or, if colostrum is not available, plasma should be provided to help the foal fight infectious diseases.
13. **Broken hoof & granulation:** A nukri-marwari mare of 12 years and used for breeding was presented with lameness grade 3. Broken left fore-hoof with excess granulation tissue formation was seen. A dorso-palmar and lateral view of x ray revealed irregular hoof. Under general anaesthesia, the granulation tissue was removed and the wound was packed with cotton bandage impregnated with ZIPP ointment. Daily bandaging with ZIPP was advised. The wound healed well with no lameness at 1 month follow up.

Outcome of equines Lameness

Out of total of 67 equines presented, 20 were culled/ condemned due to poor prognosis of the condition, 23 were subjected to minor or major surgical interventions and 20 were prescribed medicinal treatment. The remaining four were advised euthanasia due to grave prognosis as they were having open fractures, to which one owner did not agree.

One equine with one month old bilateral metatarsal fracture was advised euthanasia, but owner did not give consent, so no treatment was advised and equine died. Fractures, contractures laxities, proud flesh, SDF tear etc. were treated surgically or by applying fiberglass casts. While other cases of DJD, small proud flesh, spinal trauma etc. were treated medicinally.

The equines treated medicinally had excellent outcome in 38.46% cases, followed by poor in (30.77%), good in 23.07% and fair outcome in remaining cases.

Table 18: Table showing the analysis outcome of lameness cases (Fig. 41)

	Total equines	No follow up	Follow up	Outcome	No.	%
Medicinal treatment	20	7	13	Excellent	5	38.46
				Good	3	23.07
				Fair	1	7.70
				Poor	4	30.77
Surgical treatment	23	7	16	Excellent	5	31.25
				Good	5	31.25
				Fair	5	31.25
				Poor	1	6.25
Overall prognosis of treatment	43	14	29	Excellent	10	34.48
				Good	8	27.58
				Fair	6	20.69
				Poor	5	17.25
Culling/condemn	20	5	15	Poor	15	100.00
Euthanized	3					
No treatment	1		1	Poor	1	100.00

The equines treated surgically, had an equal of excellent, good and fair outcome (31.25% each) followed by poor (6.25%). Contracted tendons or closed metatarsal or metacarpal fractures had excellent prognosis as they were brought on time. The fiberglass in equine creates wound due to splints and soft skin. Therefore, the cast need to be changed frequently, may be at 15-20 days. As this much time period, lead to moderate consolidation of fracture in place, and further fiberglass or bandaging with splint can be applied. Contracted tendon at fetlock if brought early, may be treated without tenotomy, and can be treated by applying fiberglass with splints, which can be removed at one week. While, carpal contractures and few fetlock contractures (presented late) requires tenotomy with cast and splints. If required, the fiberglass can be reapplied at one week.

The overall prognosis for medicinal and surgical treatment with follow up outcome was excellent in maximum cases (34.48%), followed by good (27.58%), fair (20.69%) and the least was poor prognosis (17.25%).



Fig. 1. Photographs showing gross examination of hoof (a), fetlock swelling (solid blue arrow) (b), carpus (c), tarsus (d).

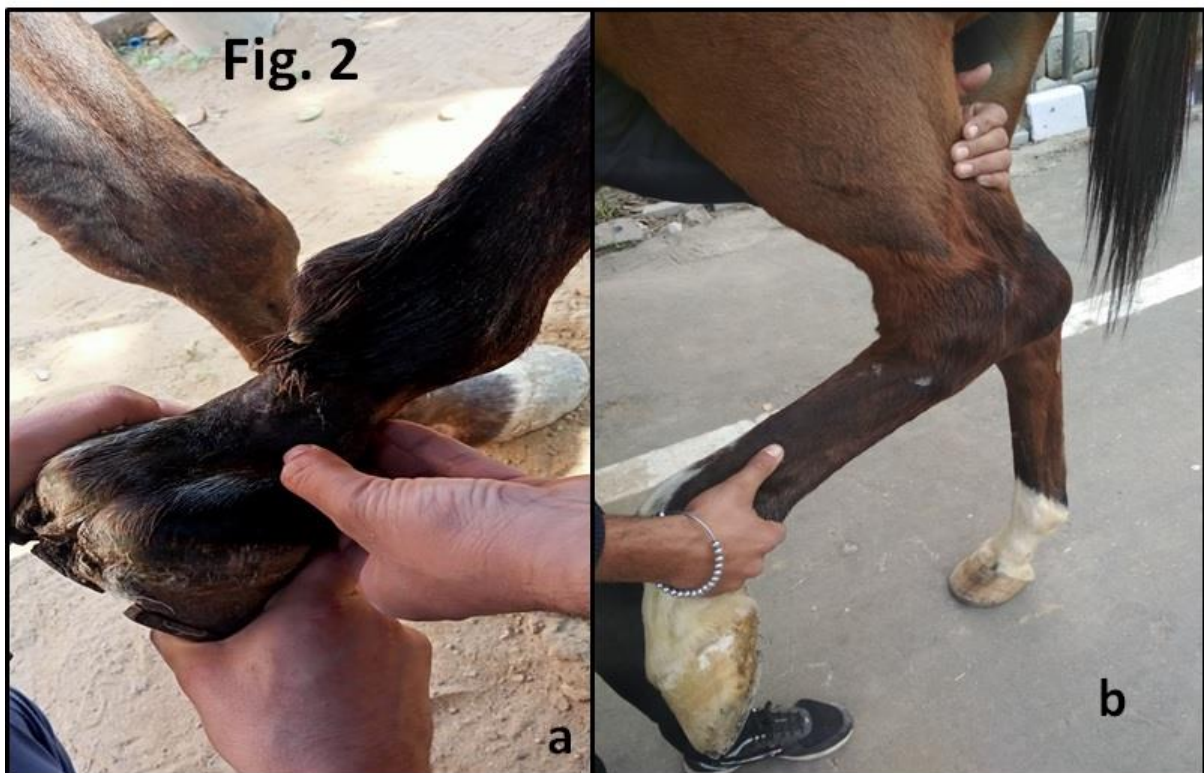


Fig. 2. Photographs showing flexion tests in distal limb (a) and Spavin test (b).



Fig. 3. Photographs showing positioning for radiography.

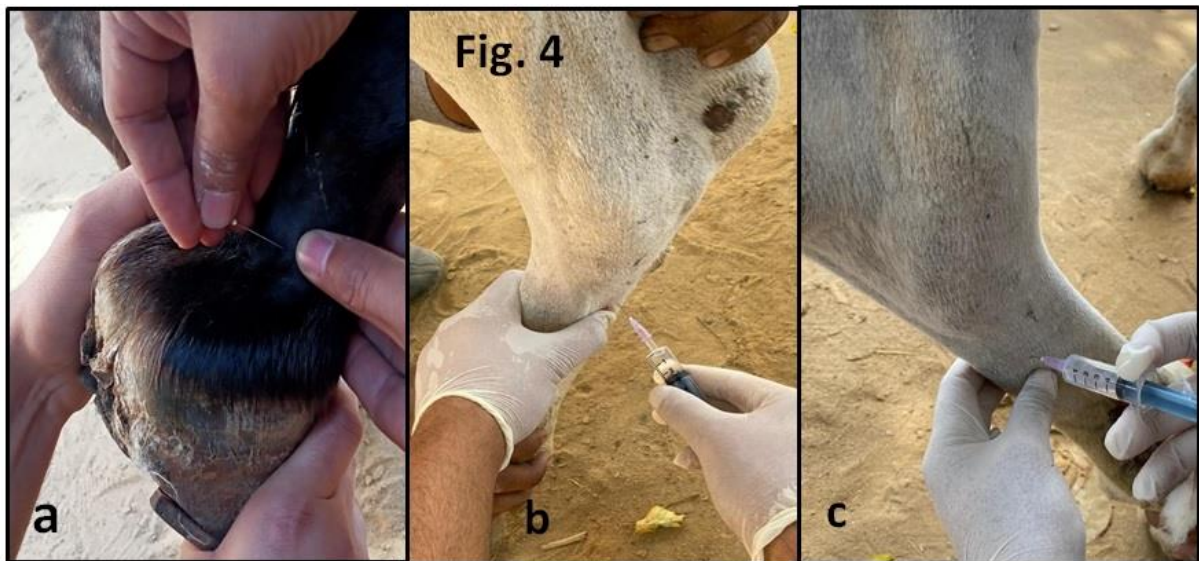


Fig. 4. Photographs showing palmar digital nerve block (a), Low 4 point block (b).

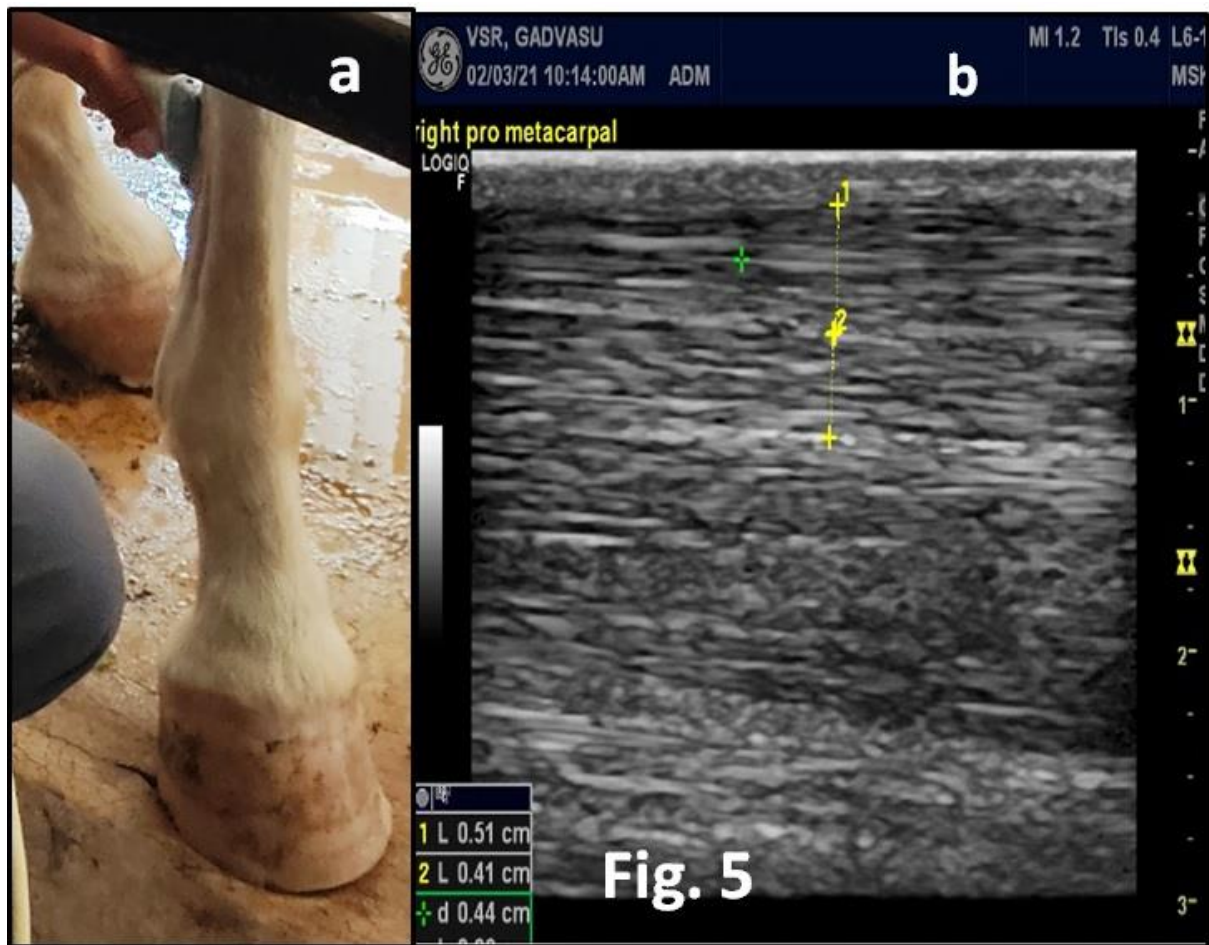


Fig. 5. Photograph showing ultrasonography of the tendon (a), ultrasonogram of sdf and ddf (b)

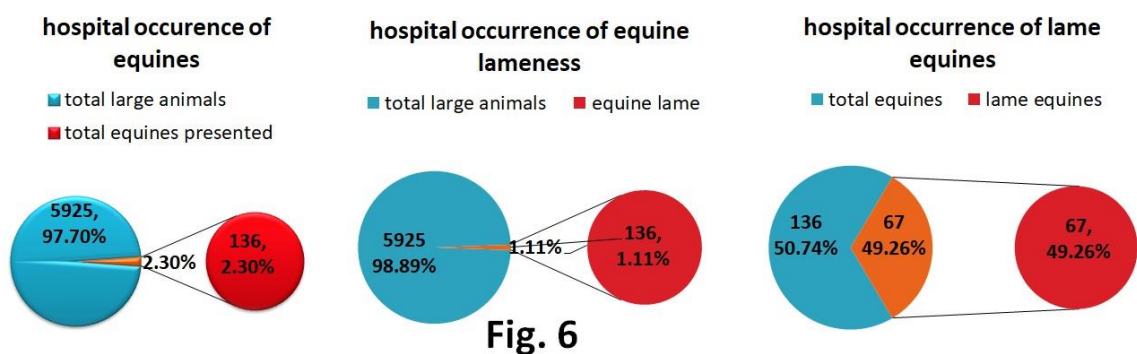


Fig. 6. Pie graph showing Hospital occurrence of equine lameness.

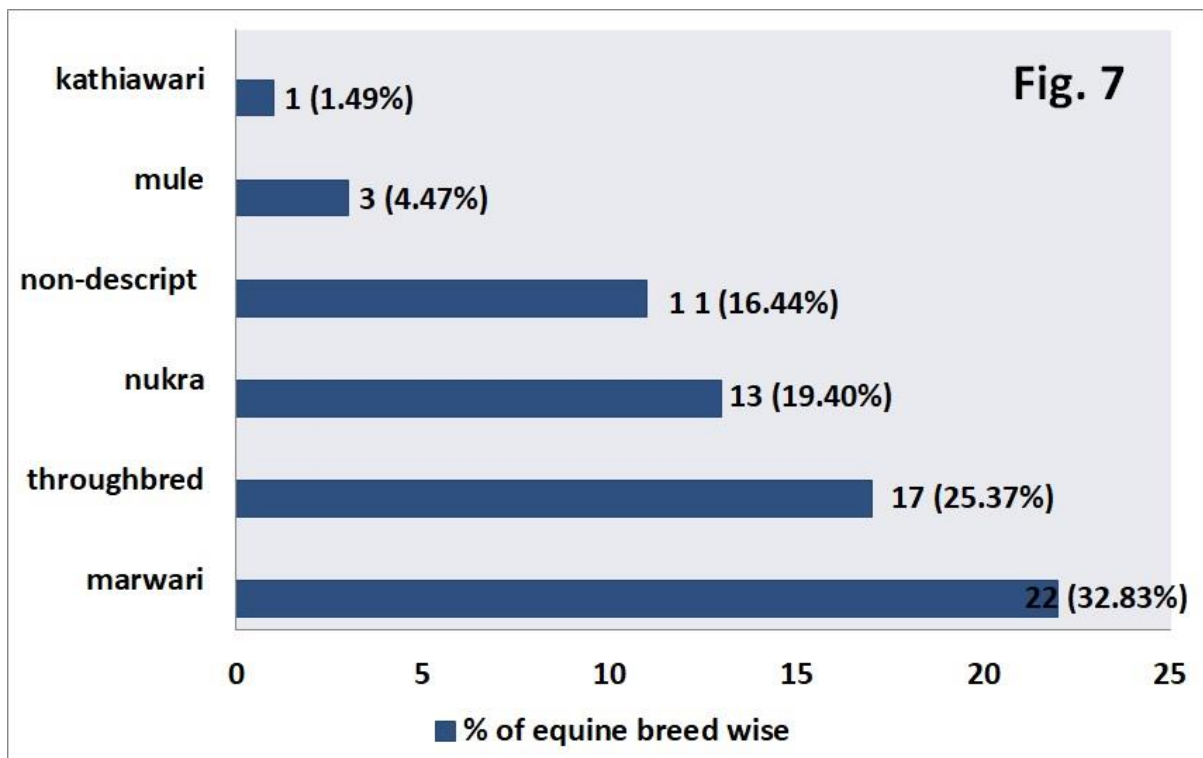


Fig. 7. Bar graph showing breed wise distribution of lame equines.

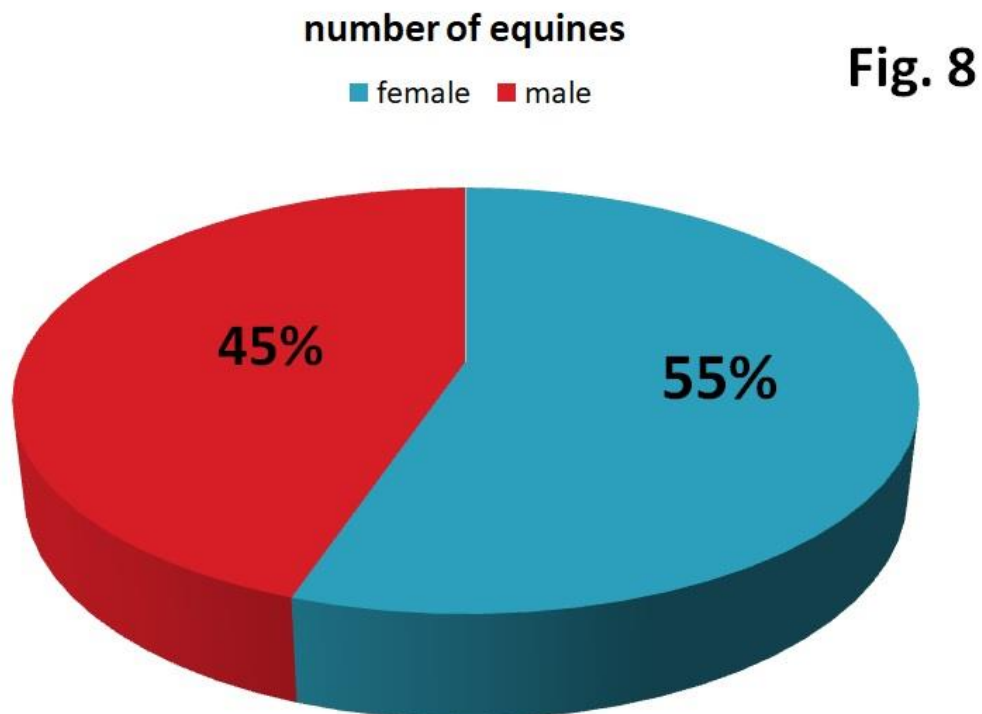


Fig. 8. Pie graph showing gender wise distribution of lame equines.

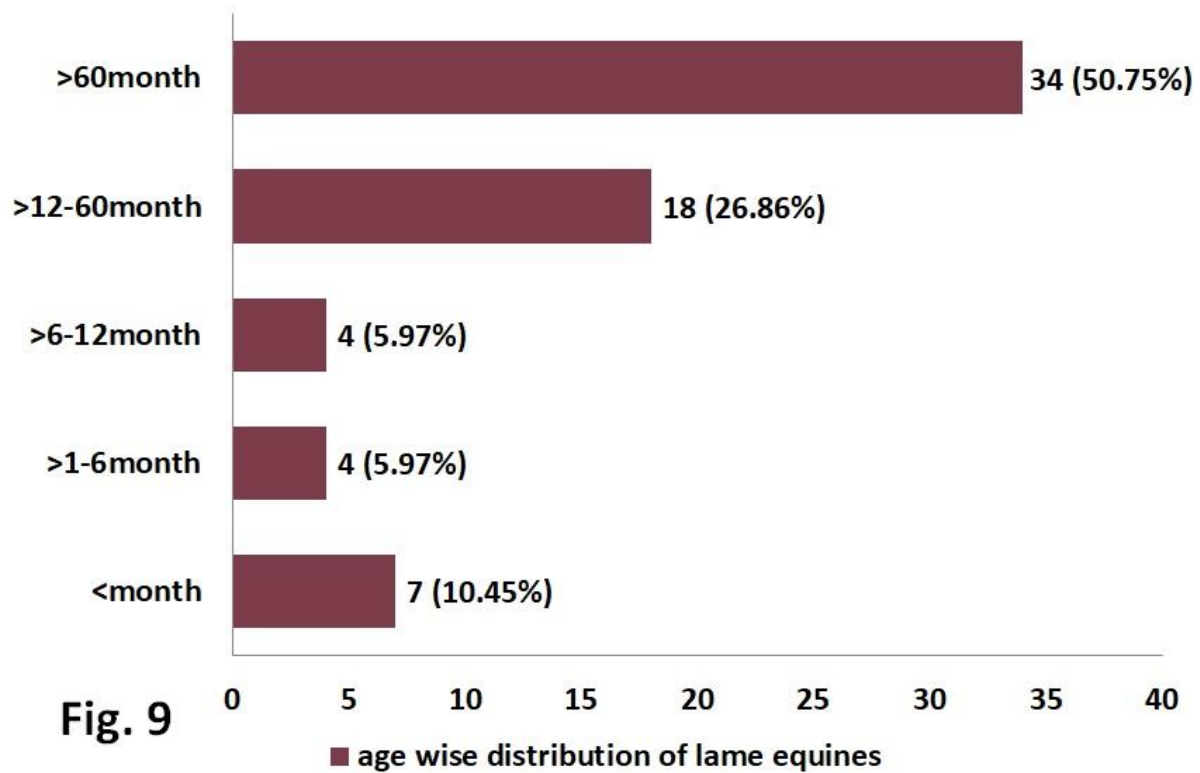


Fig. 9. Bar graph showing age wise distribution of lame equines.

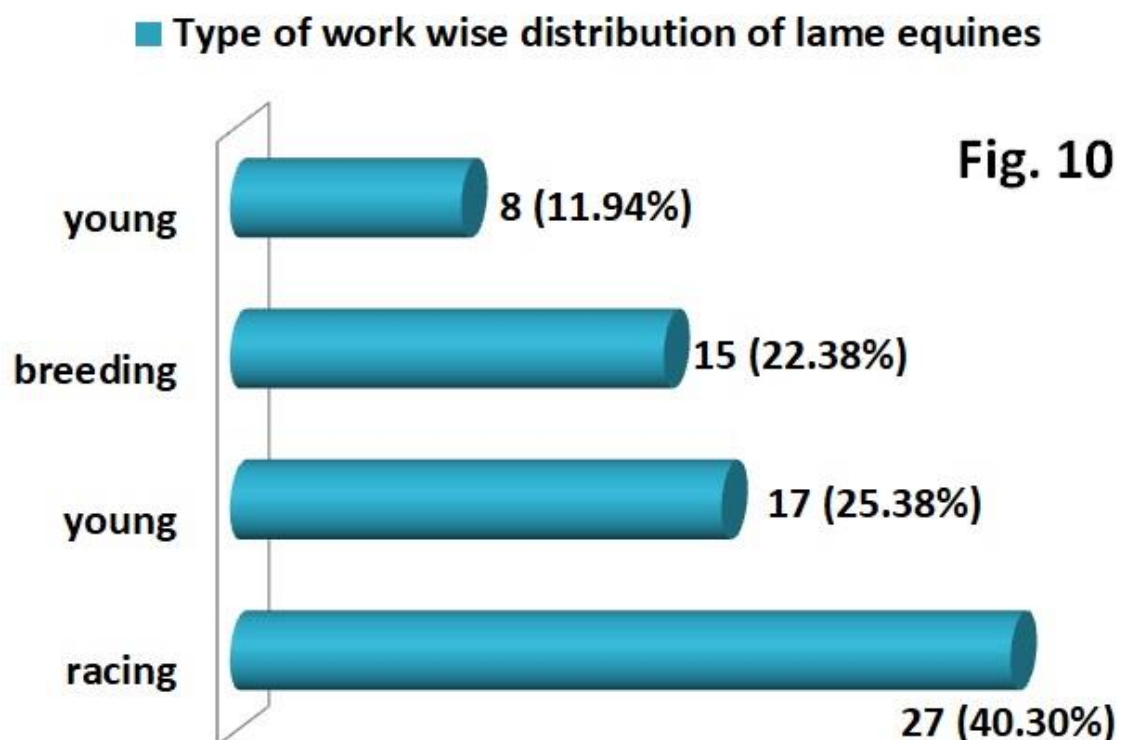


Fig. 10. Bar graph showing type of work wise distribution of lame equines.

duration of lameness wise distribution of equines

■ <3 DAYS ■ 3-10 DAYS ■ 10-30 DAYS ■ >30 DAYS

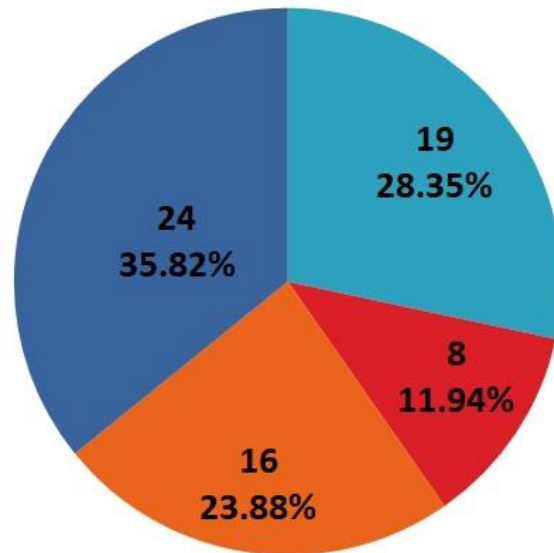


Fig. 11

Fig. 11. Pie graph showing duration of illness wise distribution of lame equines.

■ No.of Equine

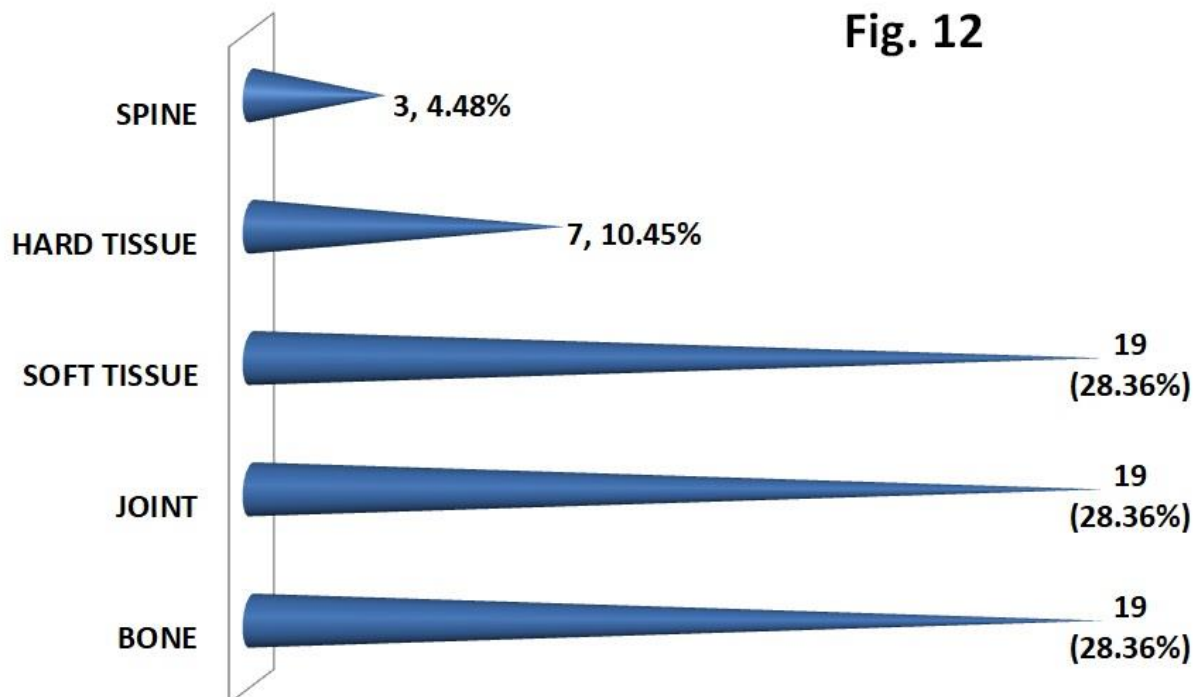


Fig. 12

Fig. 12. Bar graph showing bone, soft tissue, hard tissue, joint and spine wise distribution of lame equines.



Fig. 13. Radiograph of lumbosacral spine in a foal, showing fracture at the level of L4 vertebra (yellow arrow).



Fig. 14. Radiographs showing sesamoid bone affections. Sesamoiditis (a and b) axial sesamoid fracture (c and d)



Fig. 15. Radiograph showing fracture (crack) of 2nd phalanx in a foal.

■ radiographic lesions as per single or multiple limbs

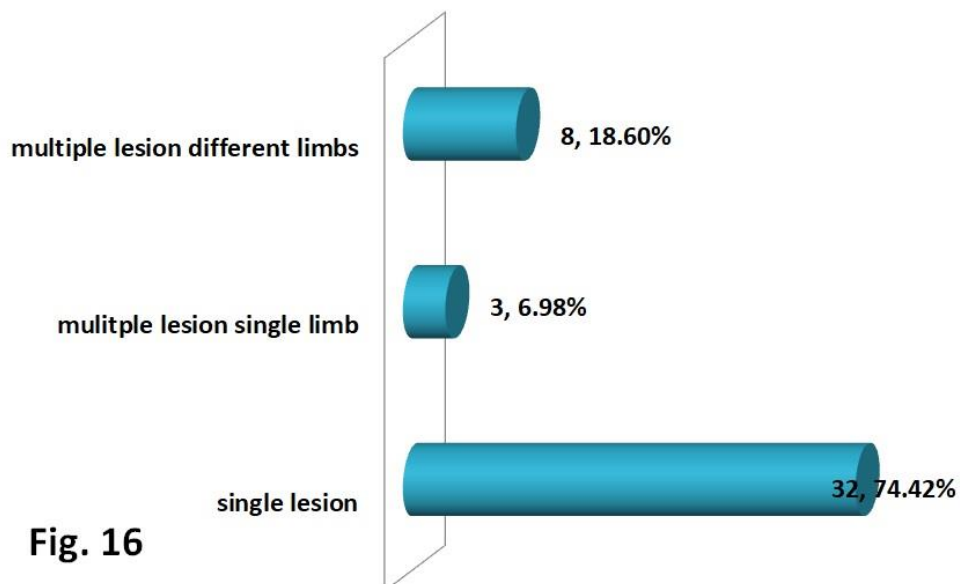


Fig. 16. Bar graph showing radiographic lesion distribution as per single or multiple limb involvement.

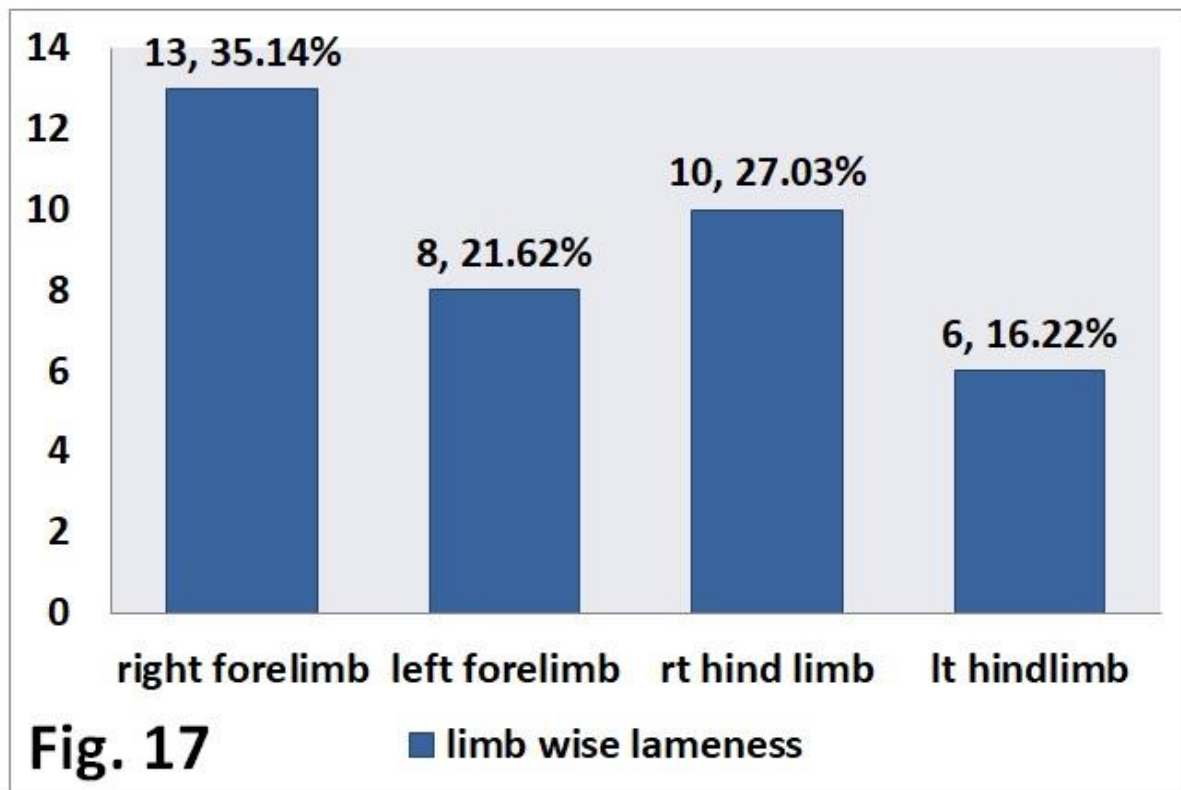


Fig. 17. Bar graph showing limb wise distribution of lame equines.

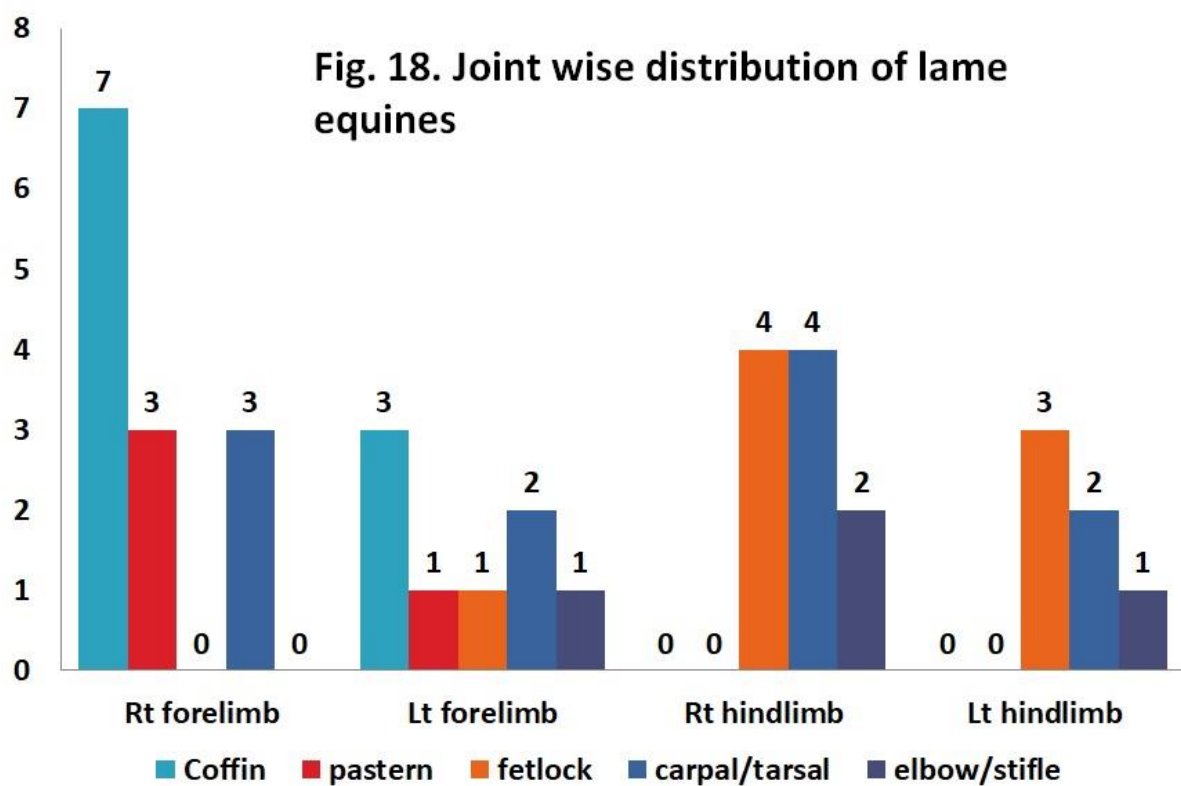


Fig. 18. Bar graph showing joint wise distribution of lame equines.



Fig. 19. Radiographs showing bilateral (a & b) and unilateral (c & d) metatarsal fractures.

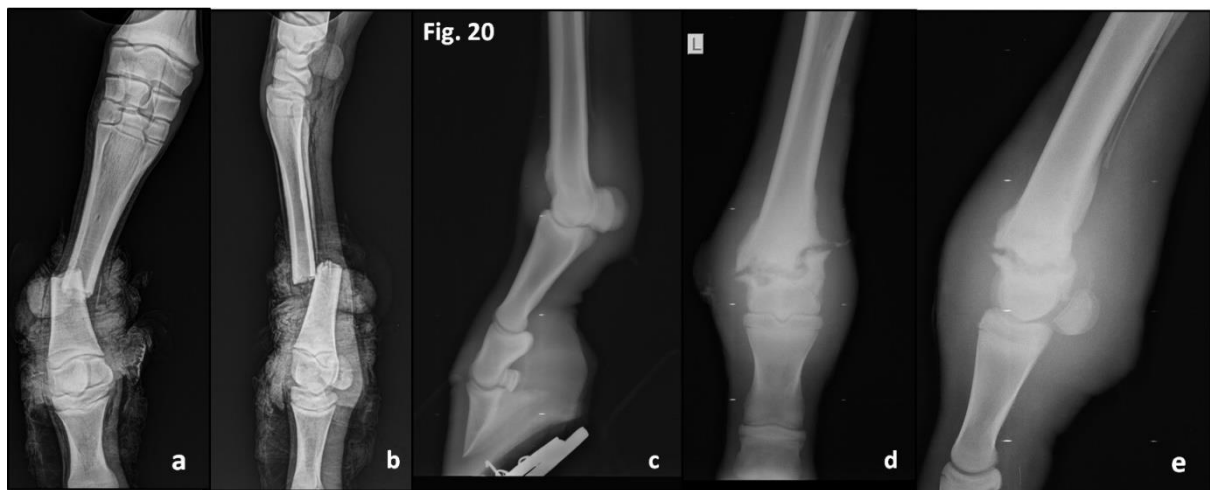


Fig. 20. Radiographs showing metacarpal fractures

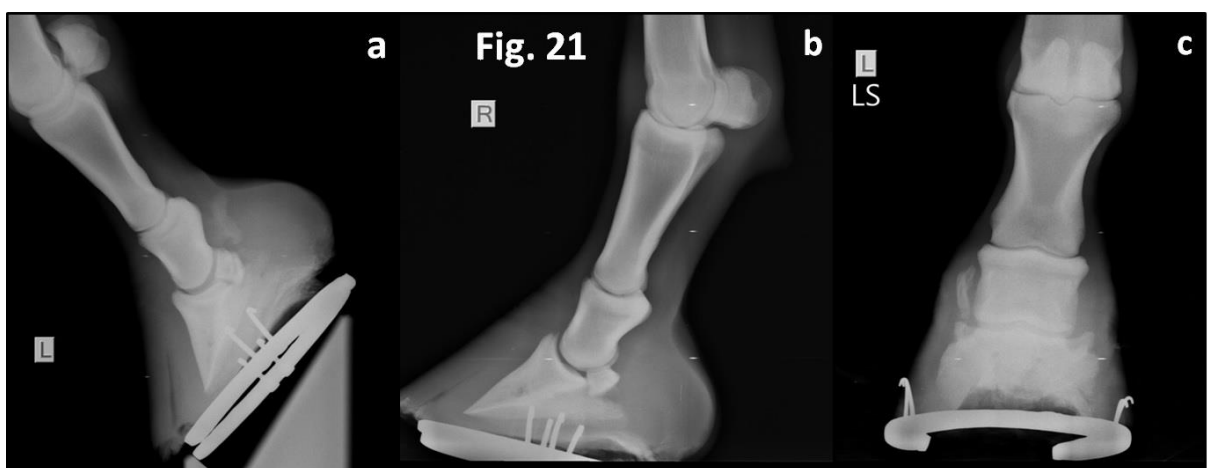


Fig. 21. Radiographs showing hoof affections. Chronic laminitis with rotation of 3rd phalanx (a and b), fracture of lateral side bone (c).



Fig. 22. Radiograph showing pastern joint affections. Fracture in 1st phalanx (a and b) high ring bone (c, d, e).



Fig. 23. Radiographs showing fetlock joint affections.

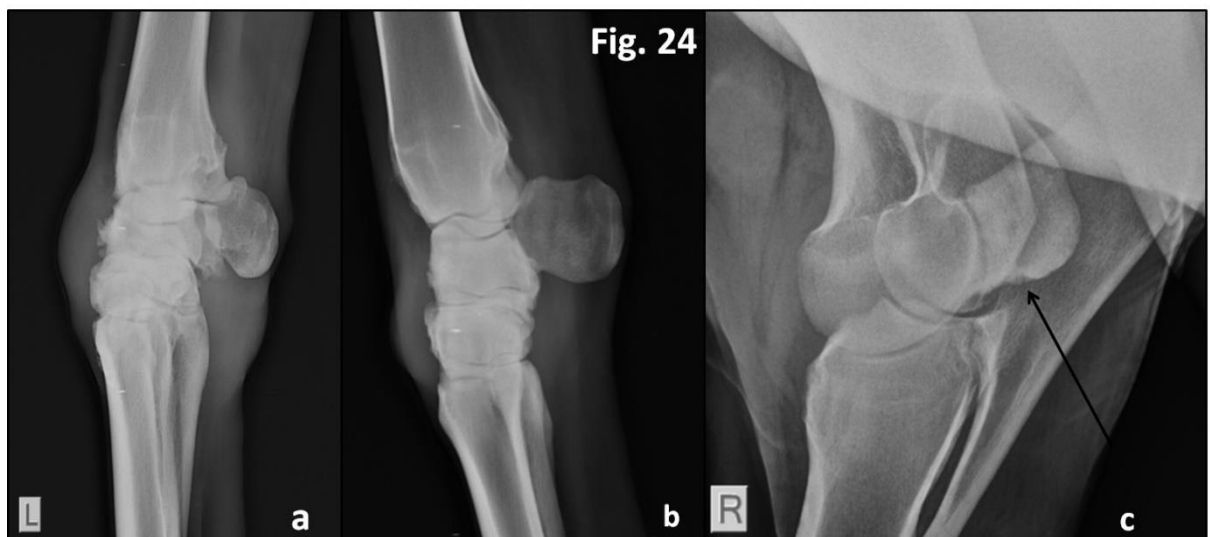


Fig. 24. Radiographs showing carpal and elbow affections. Severe periosteal reaction at carpal (a and b), OCD lesion at the condyle of right humerus (c).

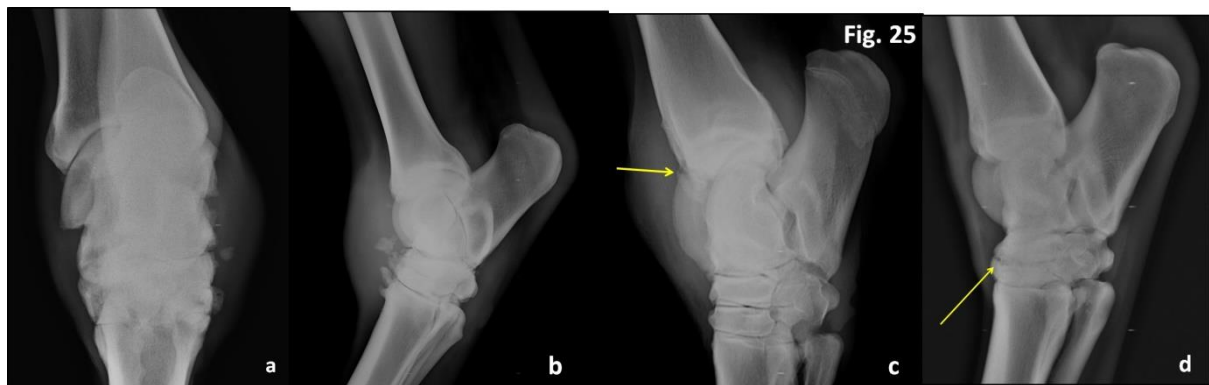


Fig. 25. Radiographs showing affections of hock joint. Periosteal reaction of talus (a, b & c), bone spavin involving distal intertarsal and tarsometatarsus (d).

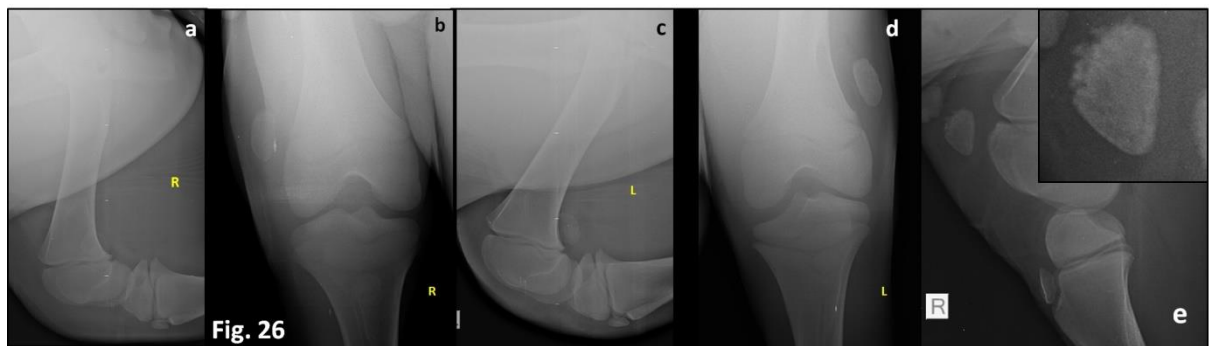


Fig. 26. Radiographs showing bilateral lateral luxation of patella in a 20 day old foal (a to d). Lysis of patella in a foal (e).

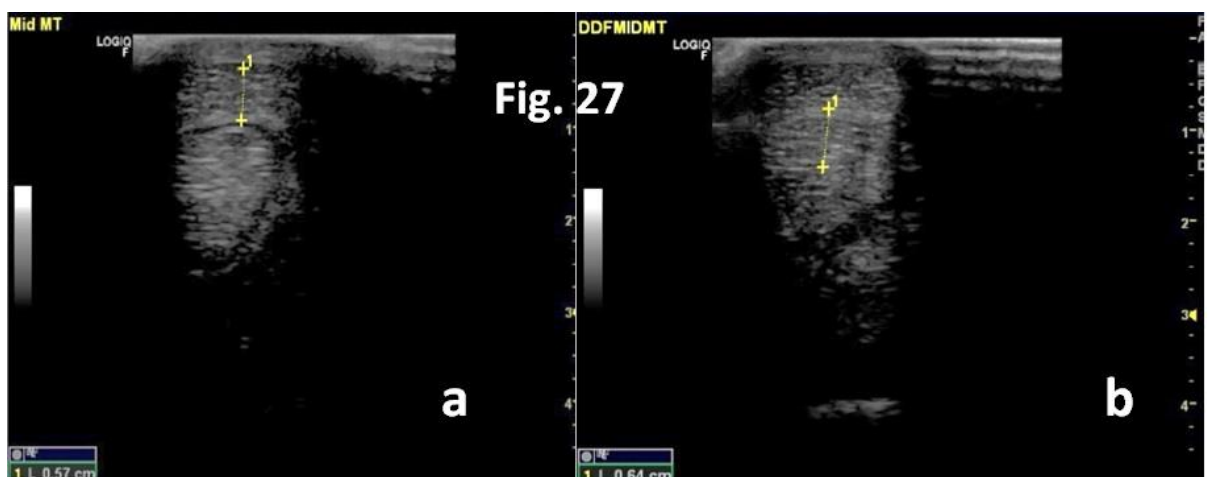


Fig. 27. Ultrasonogram showing normal USG findings in a foal with laxity of ligaments. SDF thickness 0.57cm (a), DDF thickness 0.64cm (b).

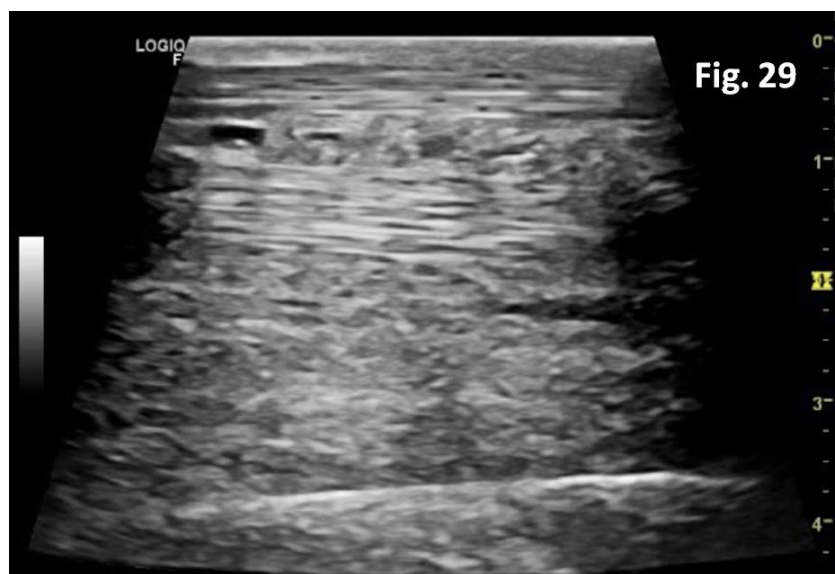
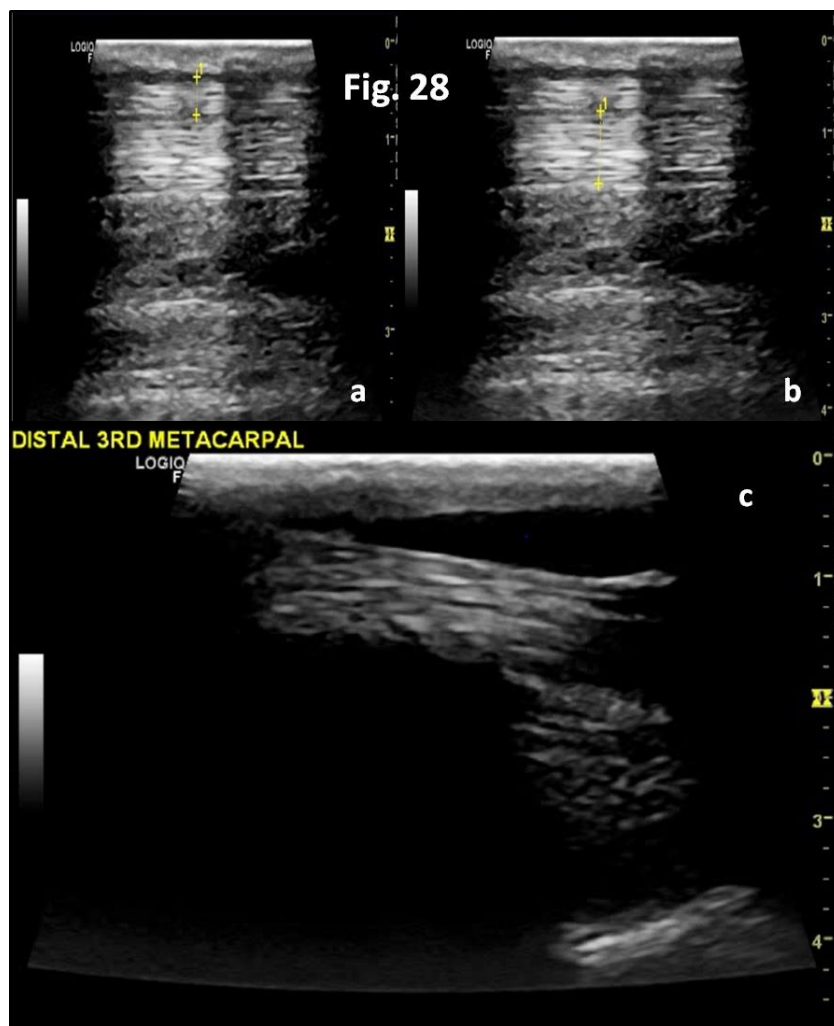


Fig. 28. Ultrasonogram showing SDF thickness 0.40cm (a), DDF thickness 0.78cm, with fluid in tendon sheath (c) in a case of ring bone.

Fig. 29. Ultrasonogram of carpus in an equine reveals small amount of fluid between SDF and DDF.

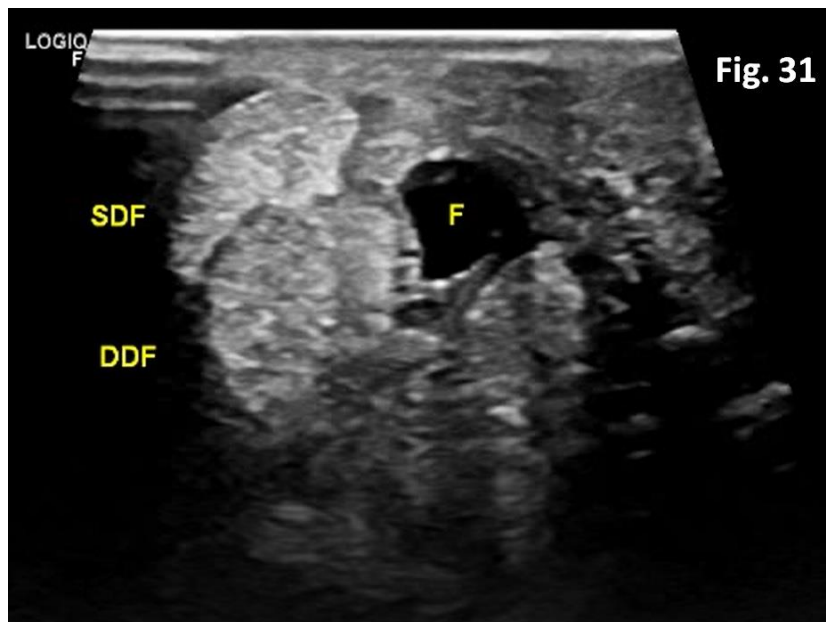
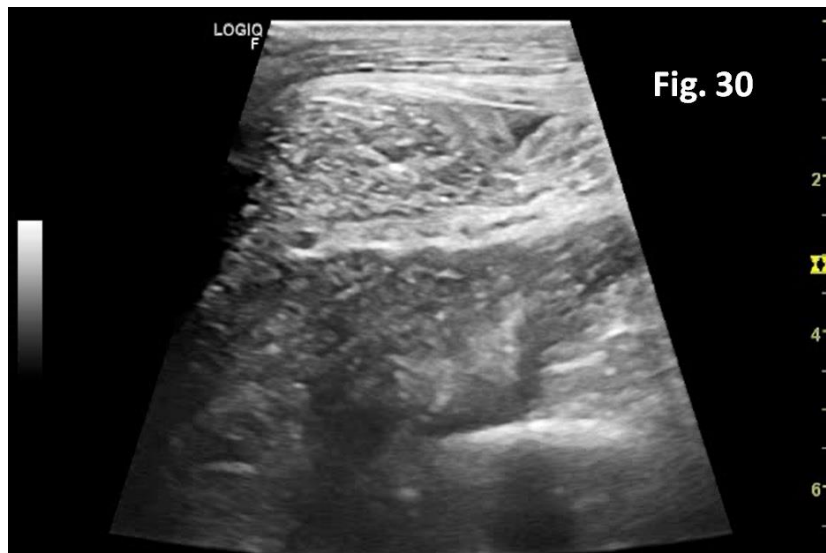


Fig. 30. Ultrasonogram of an equine with shoulder swelling. The left shoulder muscle is seen with no anechoic fluid.

Fig. 31. Ultrasonogram of an equine with tenosynovitis reveals anechoic fluid in the tendon sheath at level of proximal sesamoid bone.

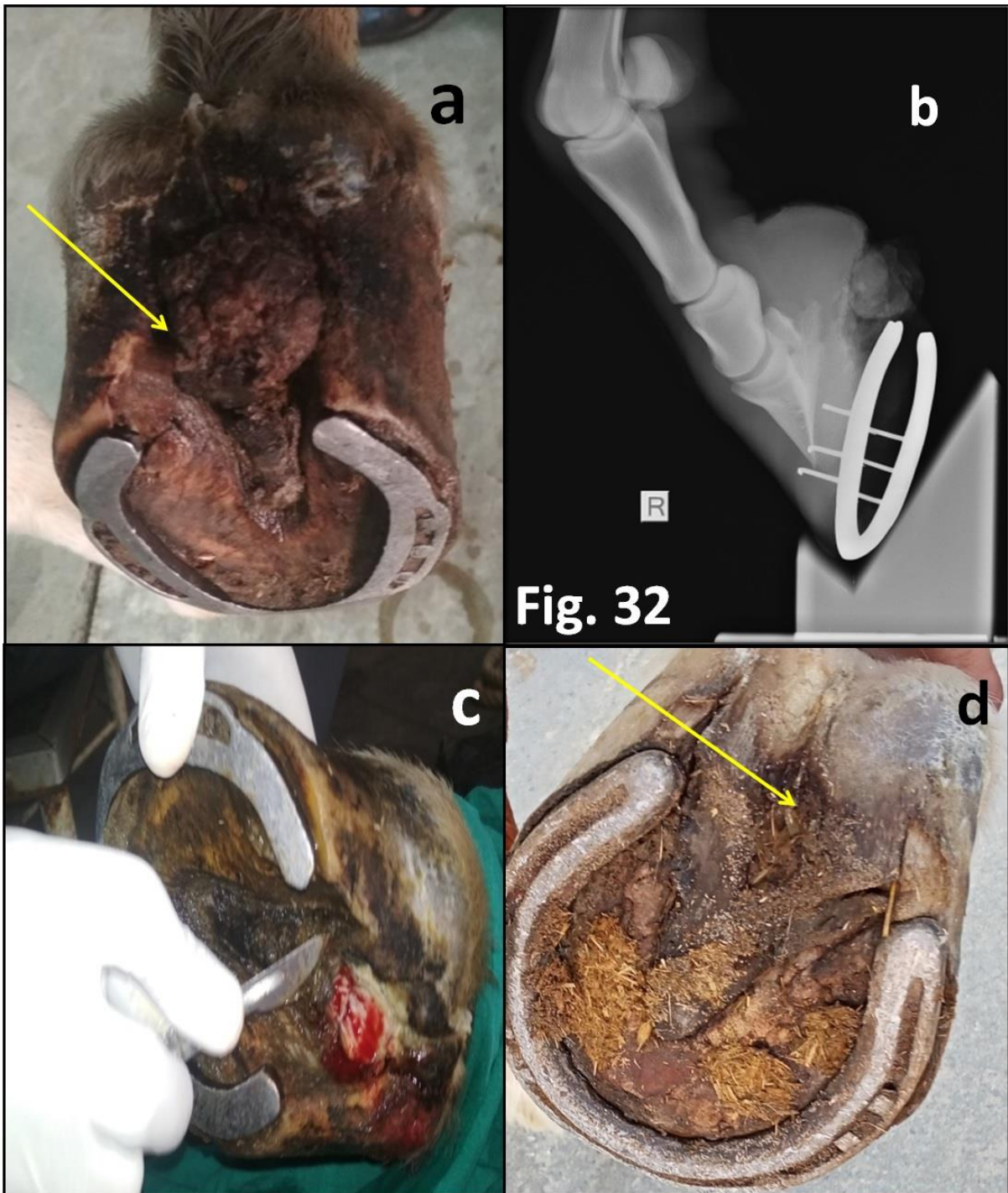


Fig. 32. Sequential pictures showing canker. Pre-operative presentation (a), soft tissue opacity at frog region on x-ray (b), intraoperative resection under G.A. (c), immediate post-op (d), 10 days follow up (d).

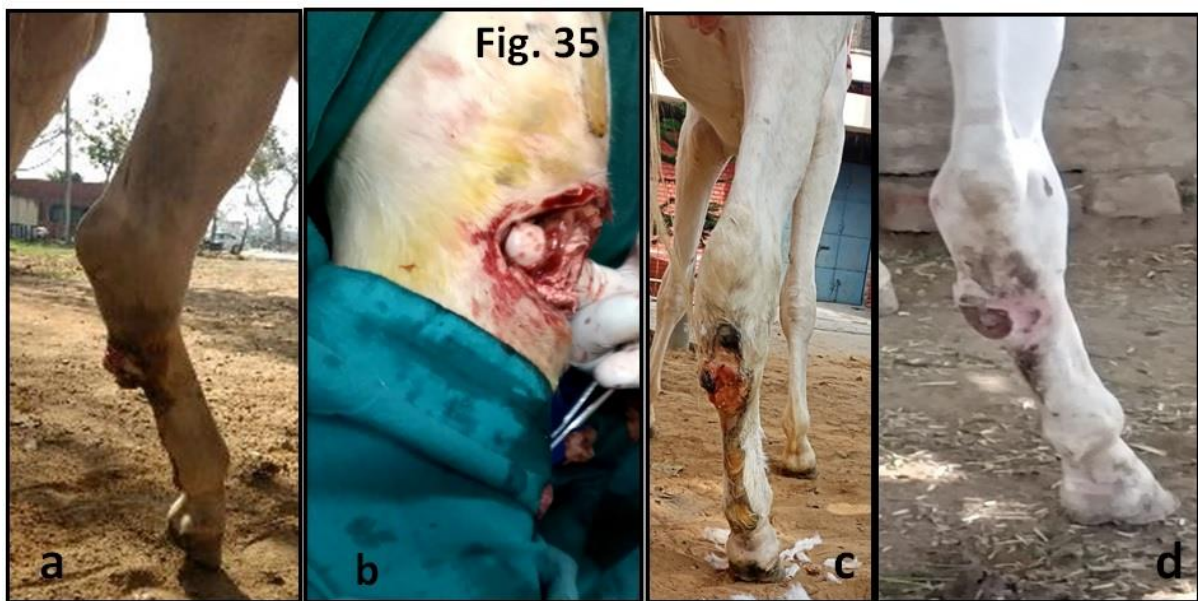


Fig. 33. Sequential photographs of bilateral patellar luxation. Pre-operative presentation (a), radiograph (b), Intraoperative (c), follow up at 45 days (d).

Fig. 34. Photograph of Broken hoof in healing phases.

Fig. 35. Sequential photographs of partial sdf tear. At presentation (a), Intraoperative debridement and suturing (b), follow up at 14 days (c), follow up at 1 month with good weight bearing but proud flesh present (d).

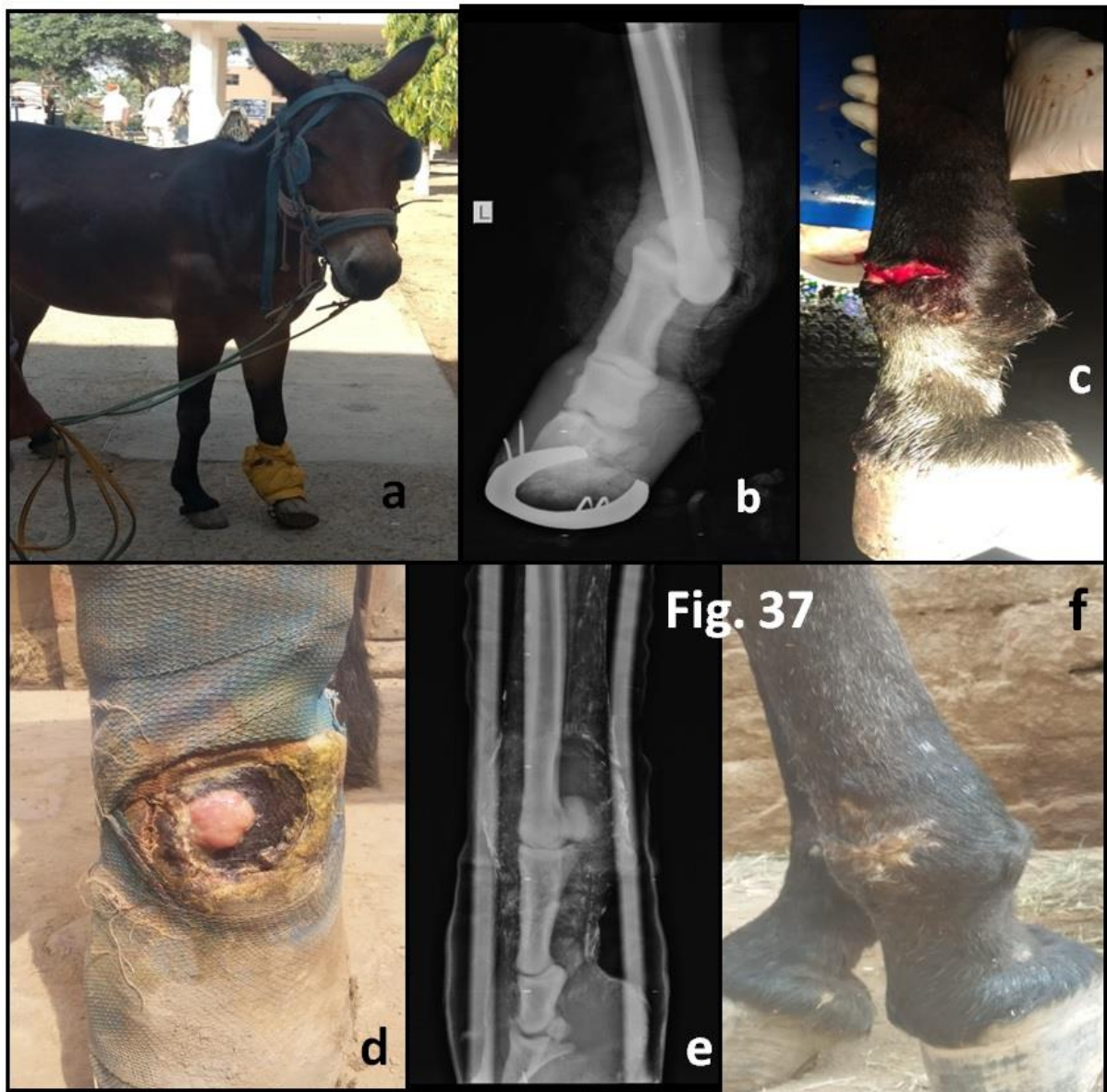


Fig. 36. Sequential photographs of contracted tendon in 3 limbs. Presentation (a), Right forelimb tenotomy of sdf (b), application of pop cast (c), Follow up at 83 days with right contracture still persists (d).

Fig. 37. Sequential photographs of open fetlock dislocation in a mule. Clinical presentation (a), radiograph of dislocation (b), Intraoperative after relocating (c), follow up at 15 day (d) , follow up x-ray at 15 days (e) healed wound at 2 month after fiberglass removal (f).

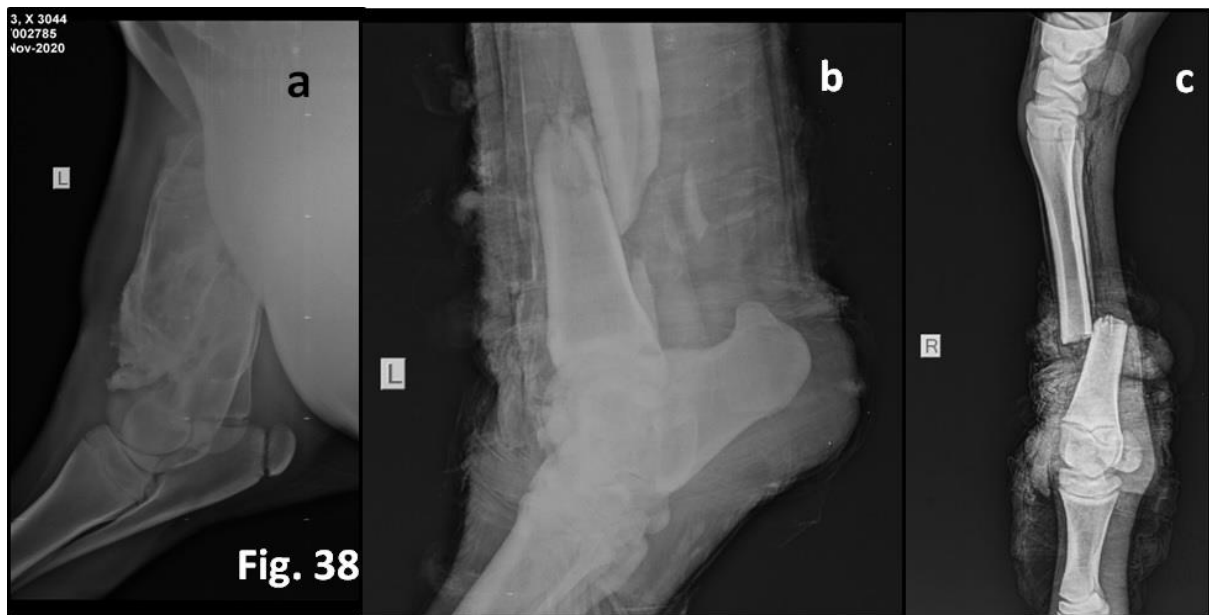
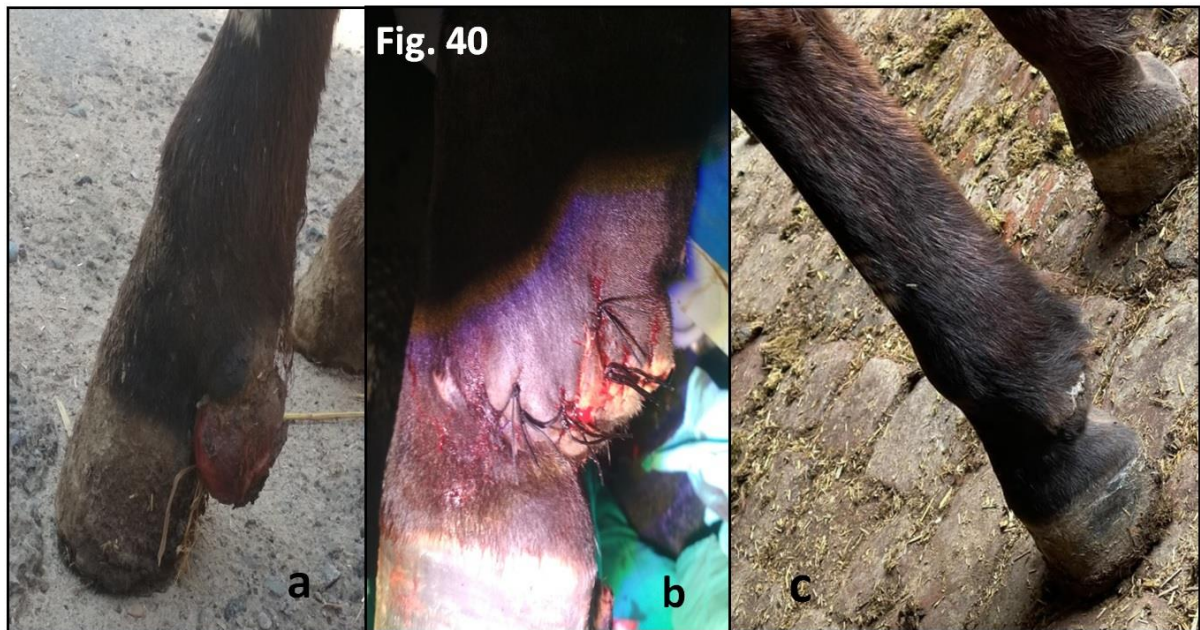


Fig. 38. Radiographs showing fracture in different bones. Humerus (a), tibia (b), metacarpal (c).

Fig. 39. . Photographs showing laxity of ligament in a foal. Clinical presentation with laxity of left fetlock (a), application of crepe bandaging (b), follow up at 25 days with no improvement (d).



■ excellent ■ good ■ fair ■ poor

Treatment prognosis (n=48 with follow up)

Fig. 41

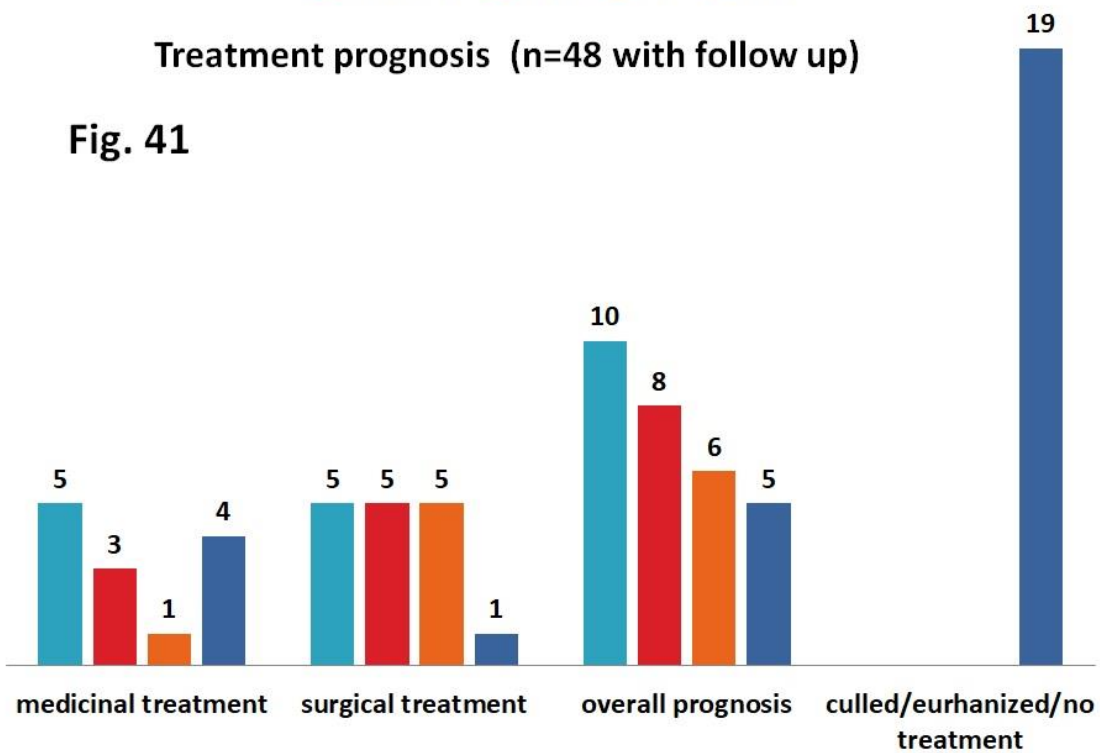


Fig. 40. Sequential photographs showing growth at fetlock. Preoperative at presentation (a), intraoperative (b), follow up at 1 month (c).

Fig.41. Bar graph showing the prognostic outcome of equines treated with medicinal or surgical therapy.

CHAPTER-V

SUMMARY AND CONCLUSIONS

The one year clinical study was done on equine presented for lameness with an aim to investigate the occurrence of equine lameness associated with bones, joints and soft tissues at University Veterinary Hospital and to evaluate the long term outcome of various causes of equine lameness.

The hospital occurrence of equine lameness was calculated as 1.11% (67/5925) among total large animals enrolled and 49.26% (67/136) among equine patients presented for different clinical ailments during one year of study at university veterinary hospital.

Among various equine breeds presented for lameness, the Marwari was maximum presented (n=22; 32.83%) followed by the Thoroughbreds (n=17; 25.37%), Nukra (n=13; 19.40%), non-descript/crossbred (n=11; 16.44%), mule (n=3; 4.47%) and a Kathiawari (1.49%). Both males and females were almost equally presented in the study. Most lameness affected equids were more than 5 years of age (50.75%) followed by those between one to five years of age (26.86%), young equines of less than 1 month of age (10.45%) and the minimum were foals of 1-6 months (5.97%) and 6-12 months of age. Most of the equines were in sports category followed by young equines. Maximum equines were chronically lame; with 35.82% cases presented after more than 30 days of onset of lameness, followed by young equines or fracture cases which were presented within 3 days of illness. The aetiology for lameness in equines presented was unknown in maximum number of cases (31.34%), followed by miscellaneous in 29.85%, fall in 16.42%, trauma in 10.45%, congenital in 7.46% and the least due to self-trauma while running or jumping in 4.48%. The hospital occurrence for equine lameness associated with bone tissue (n=19), joint (n=19) and soft tissue (n=19) was almost equal (28.36% each), followed by hard tissue (n=7) (10.45%) and spinal affections (n=3) (4.48%).

Among the young equine of ≤ 1 month of age, fracture of metatarsal or metacarpal, joint involvement due to sepsis or patella luxation and soft tissue involvement due to laxity of joints or contracted tendons were almost equally distributed. As the age of the equines increased the bone affection started increasing.

The equine in one to 6 month of age had 75% bone affections and one had soft tissue involvement. Among the age group of 6-12 months, less equine were presented, with one each having bone, soft tissue, joint and spinal affection. The sub-adult equines of 12-60 month age group had a maximum occurrence of soft tissue involvement (n=7, 38.89%) followed by joint affections (27.78%), hard tissue (hoof wall in 11.11%) and least involvement of spine (in one equine). Among the adult equine suffering from lameness, majority had joint affections (32.35%) followed by bone (29.41%), soft tissue (23.53%) and hard tissue (14.70%) involvement. Among the fractures of bone, the short bones fractures included two cases of sesamoid fracture in a Thoroughbred horse due to fall while racing or practicing, fracture of 2nd phalanx in a Nukra female with unknown history of trauma, sesamoiditis in a Marwari female with unknown trauma, 11 cases of long bone fractures including humerus (n=2), tibia (n=3), metatarsal or metacarpal (n=6). One of the metacarpal and 2 of the tibia fractures were open at presentation. One young equine aged 5 month had bilateral metacarpal fracture.

Among all the clinical parameters recorded, the pulse, heart rate and the respiration rate of equines with spinal trauma were significantly more than the other affections involving bone, soft tissue and hoof wall.

Among the bone affections, most of the equines had grade 5 lameness, due to fracture (63.16%) followed by grade 2 and 4 (15.79% each). Grade 2 lameness was present in equine with small bones involvement like sesamoids. For joint affections, maximum equines had grade 3' lameness (31.58%) while grade 2, 4 and 5 were almost equally divided. Among soft tissue lameness, the maximum equine had grade 4 lameness (42.10%) and the minimum had grade 3 (10.01%). For hoof wall affections grade 2 and 4 were equally divided (42.86%). Thrush and canker like affections had grade 2' lameness while hoof wall split or broken hoof or avulsed hoof had grade 4' lameness. Among spinal trauma equines, one was presented recumbent (grade 5) while 2 had ataxia of hind legs (grade 3).

As per gait of the equine maximum equines with bone involvement had lameness apparent during walk itself due to fractures. While those with joint affections, showed lameness at walk and trot equally. The maximum equines with soft tissue affections also showed lameness at walk itself, especially for equine with

contractures or tendon rupture. For hoof wall affections, most of the equine showed lameness at walk (for those with hoof split or broken), while for those with canker and thrush showed lameness at trot. Among spinal trauma equines, 2 had lameness on walk while one was presented recumbent.

The nerve block was applied in 5 equines, while others treated surgically, were under general anaesthesia or sedation. Among the neurological exam conducted, only 3 equines showed it positive, 2 with spinal trauma and hind limb ataxia, and one with muscle sprain showed swinging.

In the current study out of 67, 59 lame horses were subjected to radiographic examination and were detected with 78 lesions involving same or different limbs. Radiography alone detected 54 lesions in 43 horses while the remaining 13 cases had soft tissue lesions in which radiography ruled out bone and joint involvement. Out of 43, most cases of equine lameness (74.42%, n=32) had single radiographic lesion, whereas the remaining (25.58%, n=11) had multiple lesions involving one limb (6.98%, n=3) or more than one limb (18.60%, n=8).

The study showed that majority of lameness cases, arising from joint affections, were from forelimbs (n=21; 56.75%) as compared to hind limb (n=16; 43.25%). Out of all four limbs, right forelimb was most frequently affected (n=13; 35.14%), followed by right hind limbs (n=10; 27.03%), left forelimb (n=8; 21.62%) and least the left hind limb (n=6; 16.22%). Based on radiographic occurrence, the coffin joint of forelimbs was most frequently affected (27.03%) followed by hind limb fetlock joint (18.92%), Tarsal (16.22%) and carpal joint (13.51%).

Apart from the fractures, osteophytes leading to arthritic changes in various joints were seen in 25 equines. In this study, a total of 10 cases of lameness with coffin joint affection, 4 of pastern, 8 of fetlock, 5 of knee, 6 of tarsus, one of elbow and 3 of stifle were presented.

Ultrasonography was performed in 5 equines, presented with soft tissue involvement for lameness with or without bone / joint lesion. No significant abnormality was noticed in foal with laxity of ligaments however, in case of ring bone, carpalis, tenosynovitis and shoulder joint USG mostly revealed fluid in sheath.

The 23 equines were treated using surgical procedures, 20 with medicines and 20 were condemned, 3 euthanized and one owner did not agree for euthanasia. Surgically treated conditions included; canker, bilateral patellar luxation, broken hoof with granulation, partial SDF tear, contracted flexor tendons, compound fetlock dislocation, fractures, laxity of ligaments in foals, growth on fetlock, broken hoof, thrush, septic arthritis of stifle.

The equines treated medicinally had excellent outcome in 38.46%, followed by poor in (30.77%), good in 23.07% and fair outcome was in least number of cases. The equines treated surgically, had an equal of excellent, good and fair outcome (31.25% each) followed by poor (6.25%). The overall prognosis for medicinal and surgical treatment with follow up was excellent in maximum cases (34.48%), followed by good (27.58%), fair (20.69%) and poor prognosis (17.25%) in least number of cases.

Conclusions:

- The annual hospital occurrence of lameness in equine is 49.26%.
- Lameness associated with bone, joint, soft and hard tissues is more frequent in above 5yrs old, Marwari breed and involving right forelimb equines.
- Coffin joint of forelimb and fetlock in hind limb are most frequently affected in equine lameness.
- Congenital affections like patellar luxation, fetlock joint laxity and flexor tendon contracture of distal limb have favourable long term prognosis with surgical intervention. Besides, various surgical affections without involving joint(s) had good prognosis.
- Lameness associated with soft tissue lesions have favourable prognosis with medicinal therapy.
- High incidence of chronic and severe lameness lesions is the major reason for poor prognostic outcome or condemnation of the equines that suggest an urgent need to initiate client education/awareness programs; besides strengthening diagnostic and therapeutic facilities.

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VITA

Name of the student : Kush Karan
Father's name : Baldev Raj
Mother's name : Santosh Rani
Nationality : Indian
Date of birth : 02 August,1995
Permanent home address : Vill: Wasal Mohan Ke, P.O: Pindi,
Teh: Guruharsahai, Dist: Ferozepur

EDUCATIONAL QUALIFICATION

Bachelor degree : B.V.Sc. & A.H.
University : GADVASU, Ludhiana
Year of award : 2019
OGPA/OCPA/% marks : 8.22/10.00
Master's degree : M.V.Sc.
OCPA : 8.592 / 10
Awards/Distinctions/Fellowships : University merit scholarship during MVSc programme