SURGICAL MANAGEMENT OF EXPERIMENTALLY INDUCED COXO-FEMORAL LUXATION IN CALVES

By

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THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Surgery
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
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1998

DECLARATION

I hereby declare that the thesis entitled "**SURGICAL MANAGEMENT OF EXPERIMENTALLY INDUCED COXOFEMORAL LUXATION IN CALVES**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Mannuthy
9th Dec. 1998

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CERTIFICATE

We, the undersigned members of the Advisory Committee of **Sri. Dinesh, P.T.** (96-13-30), a candidate for the degree of Master of Veterinary Science in Surgery, agree that the thesis entitled "**SURGICAL MANAGEMENT OF EXPERIMENTALLY INDUCED COXOFEMORAL LUXATION IN CALVES**" may be submitted by Sri. Dinesh, P.T., in partial fulfilment of the requirement for the degree.

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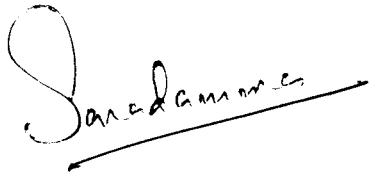

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DINESH, P.T.

Dedicated To My

Beloved Parents

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Introduction

INTRODUCTION

Considerable production loss is sustained in the livestock sector due to various disease conditions affecting the musculoskeletal system (Radostits *et al.*, 1994). Data on the incidence of luxation of hip joint is not readily available. Dislocation of the hip joint is the second commonest of the dislocations occurring in animals (Greenough *et al.*, 1981) and it forms a perplexing problem to practicing veterinarian. A seasonal incidence coinciding with mating and calving seasons was reported (Jubb *et al.*, 1989). During oestrus and in late gestation the hyperoestrogenic character causes the pelvic ligaments and muscles supporting the joint to relax and even minor trauma during these periods may cause dislocation of the hip joint. The condition was reported to be more common in females than in males at the age group of two to five years (Singh and Tayal, 1993).

Shallow acetabulum in cattle may predispose to dislocation of hip joint (Frost and Sunderville, 1932) as also the lack of prominent acetabular rim, presence of notches at the margin, small articular head of femur, absence of pubofemoral ligament and under development of supporting structures of joint (Singh and Tayal, 1993). Violent over extension and falling on the point of stifle with femur in a vertical position (Malark *et al.*, 1992) or pathological and

degenerative conditions of the joint, articular ligaments and paralysis of nerves and muscles may also cause dislocation of hip joint.

Surgical treatment is advocated in hip dislocation in small animals by open or closed reduction and subsequent immobilisation (Whittick, 1974). However such techniques have limitations when they are adopted in large ruminants because of the heavy body weight, the strain imposed on the immobilizing mechanism and the problem of sepsis. Added to this are the complications created by prolonged recumbency and loss of function, which ultimately lead on to the culling of the affected animals resulting in great loss to the farming community. Hence it becomes necessary that the technique adopted for reduction and retention be safe and cost effective.

The present study was undertaken with the following objectives.

a. To design and devise a suitable treatment for correction and fixation of luxated femoral head in calves.

b. To evaluate the efficacy of open and closed methods of reduction and fixation in the treatment of coxofemoral luxation in calves.

Review of Literature

REVIEW OF LITERATURE

Frost and Sunderville (1932) explained the anatomy of the hip joint in cattle in comparison to equines. Bilateral luxations of the hip joint was found to be common due to slipping, violent injury and obturator nerve paralysis during parturition. Diagnosis was based on physical examination, position of trochanter and the head of the femur. They suggested destruction of affected animals as the treatment was unsuccessful due to incomplete replacement of femoral head in the acetabular cavity.

Rainey (1955) reported cases of post parturient recumbency in cows caused by rupture of round ligament. Auscultation revealed loose fitting of femur in the acetabulum.

Adams (1957) reported that incordination due to partial or complete paralysis of obturator nerve, relaxation of the sacrosciatic ligament and milk fever as the predisposing causes for hip luxations. He employed shuttle pin apparatus for correcting coxofemoral luxations and subluxations in

cattle. The apparatus was prepared out of 18 gauge stainless steel wire and a shuttle pin with 3/16th inch threaded shaft. The shuttle pin and the threaded shaft were guided through a hole drilled on the femoral shaft and acetabulum and the pin was turned per rectum. Screws were fixed on lateral aspect of the femur. Trials were conducted through craniolateral approach in ten animals, out of which seven recovered satisfactorily.

Rham (1959), reported a case of coxofemoral luxation with upward and forward displacement in a cow aged three years. Correction of luxation was carried out using traction and counter traction under epidural anaesthesia. The author used a "Bag Shaws" cattle hoist to lift the animal. The luxation reccurred in three days.

Greenough (1960) successfully used closed method of reduction of hip luxation in three calves under chloral-hydrate anaesthesia. He advocated fixing the pelvis to a fixed object by passing a rope medial to the thigh around ischium and ilium. Limb was then forcibly extended. When maximum traction was attained, thumb pressure applied on greater trochanter combined with outward rotation of hock and inward rotation of stifle effected reduction of head into acetabulum with an audible click. All animals were completely sound with in 24 hours and had no recurrence.

Leonard (1964) suggested use of a half pin splint anchorage for retention of the femoral head in position after closed reduction of luxated hip joint in dogs and cats. This was carried out by pinning on either side of the acetabulum and connecting these bars. A pin was then inserted into the femur on the lateral aspect just below the trochanter major. When this pin was connected to anchoring bars, lateral pressure could be applied to femoral head. This fixation inhibited abduction and adduction, allowing flexion and extension of the hip while fixing the femoral head in acetabulum.

Mackay and Smith (1964) reported two cases of coxofemoral luxation in ponies. The condition was diagnosed by the abnormally elevated position of trochanter. The treatment adopted was excision of femoral head and neck through an anterior approach using a horizontal incision. The animals were able to trot and canter normally along with the herd by one year after surgery.

Rees (1964) successfully treated three out of eight cases of coxofemoral luxation in dairy cattle with closed method of reduction under chloral hydrate anaesthesia. A rope was fastened around the hock to apply traction and a hand was introduced through rectum to lift the femoral head from the obturator foramen. Reduction was evidenced by an audible

click. Failure in other cases were attributed to insufficient traction and lapse of time after the incident.

Weaver (1969) diagnosed nine cases of dislocation of hip joint by radiography and by symptoms like crepitus, swelling over gluteal region, abnormal position of trochanter major, reduced movement of the limb and presence of femoral head in the obturator foramen. Closed reduction and recumbency for two days were tried. Recurrence of the condition was observed. Open hip surgery was also done with limited success. The complications observed were gluteal abscess, sciatic neuropathy and muscular atrophy.

Sahu *et al.* (1970) performed excision arthropathy of femoral head in five buffaloe calves as a salvage procedure in hip luxations. Curvature of vertebral column, shortening of operated limb, atrophy of gluteal muscles, ankylosis of femur and acetabulum and slight degree of lameness were noticed throughout the observation period.

Fretz *et al.* (1973) adopted excision arthroplasty as a mean of treatment for the fracture of proximal femur and dislocation of hip joint in calves. The results were encouraging as the treatment alleviated pain and reduced bone to bone contact.

Sahu and Saxena (1976), used excision of femoral head and neck through a dorsolateral incision for the successful treatment of coxofemoral luxations in bovines.

Sali and Zanardelli (1976) treated dislocated hip joint in a calf by producing pseudoarthrosis. Under deep sedation with xylazine, a steel pin was inserted through a large fold of skin above the trochanter. An area of skin about 10-12 cm diameter was tightly tied with twine below the pin. This produced an area of necrosis which favoured development of pseudoarthrosis. The calf had regained almost normal function of affected limb in three months.

Tulleners (1983), reported that acetabulum in cattle was relatively shallow, which resulted in less acetabular covering of femoral head and hence a high risk of recurrent luxation. Reluxation was common in cases where closed reduction was tried because of the inability to remove the soft tissue debris from acetabulum. The difficulty for the accurate assessment of correction also contributed to reluxation.

Leighton (1985), reported a craniodorsal or a dorsal approach to hip joint for fixation in cases of dislocation in dogs. After correction of luxation, fixation was achieved by the use of screws and nonabsorbable suture material. Two short self tapping screws were fixed on the dorsal acetabular rim, while the third screw was inserted in the cranio dorsal aspect of femur. The suture material was looped around the screws on acetabular rim and on the femur.

Tulleners *et al.* (1987) diagnosed 22 cases of traumatic and unilateral hip luxations in female dairy cattle. Dorsal and ventral dislocations were differentiated by physical examination. It was difficult to distinguish between luxations and fractures of proximal end of femur. Closed reduction was accomplished in one case only. Open reduction was performed under general anaesthesia using halothane. The animal was well secured and hip joint was approached through a craniolateral incision. Correction of the luxation was carried out by the use of a mechanically assisted calving device. Open reduction was found successful in 95 per cent cases.

Jubb *et al.* (1989), recorded details of 47 cases of coxofemoral luxations in cattle over a period of one year and reported about the prognostic factors for recovery. The most useful single factor was the animal's ability to stand

before reduction. Other factors involved were age, body weight and duration of luxation. They also reported seasonal incidence of dislocations coinciding with the calving and mating periods.

Larcombe and Malmo (1989), diagnosed coxofemoral dislocation in 40 dairy cows. Seventy five per cent cases were successfully treated by closed reduction. Most cows were treated within 12 hours of occurrence of dislocation. Treatment was less successful in cases of caudoventral luxation. Unsuccessful cases predominated among cows with concurrent obstetrical paralysis or milk fever and in very heavy animals.

Pattanaik *et al.* (1990) compared dorsal approach with bisection of gluteal muscles and dorsolateral approach along with trochanteric osteotomy for the fixation of luxated hip joints in cattle. The authors used prosthetic round ligament fabricated with stainless steel steinmann pins and a piece of air plane cable for the repair of experimentally induced hip luxation in six bovines. In the first four animals complications like breakage of steel wire used for fixing trochanter major and breakage of cable were encountered. Fixation of trochanter with two threaded nails and stainless steel wire and the use of modified ligament gave successful results in two animals.

Sqire *et al.* (1991), performed femoral head ostectomy in six horses, three ponies and four cattle for the treatment of fractures of proximal femur, acetabulum, coxofemoral luxation

and severe degenerative diseases of femoral head and acetabulum. A cranial approach to the hip joint without osteotomy of the major trochanter was chosen for surgery. They stated that excision of femoral head was a viable salvage procedure for large animals. Prognosis appeared to be favourable in young cattle and fair in young horses or ponies weighing less than 100 kilogrammes (kg).

Madison and Johnston (1992), described successful method of open reduction and fixation of the hip joint in a four day old Jersey calf. Stabilization of luxated hip was effected by translocation of the greater trochanter slightly distal and caudal to the original site. Ehmer sling was applied for 10 days postoperatively.

Malark *et al.* (1992) reviewed 17 cases of coxofemoral luxations in horses and most of them were caused by severe trauma. The incidence was higher in ponies and miniature horses of an average age of seven years. Seventy per cent of cases were recorded in females. Thirty five per cent had other orthopaedic injuries associated with luxation. Closed reduction using a mechanically assisted calving device was attained in five cases. Reluxation occurred immediately in four animals. Various surgical techniques were used in three cases. None was found successful in maintaining reduction. Ponies and miniature horses were better to handle

lameness and therefore had a better long term survival rate than horses with chronically luxated coxofemoral joint.

Meij *et al.* (1992) described a method of extra articular stabilization following open reduction of the hip luxation in dogs and cats. The method described was simple, required minimum postoperative care, early weight bearing was achieved and a second surgery was not necessary. In intra articular technique, complications mentioned were migration of implants, foreign body reaction and direct damage to articular surfaces which induced degenerative diseases.

Tanger (1992), described different methods for the management of traumatic hip luxations. In the treatment for cranio dorsal luxation, success rate was 50 per cent in closed reduction. He had discribed the technique of open reduction and fixation using prosthetic capsular technique with cent per cent success rate.

Balagopalan *et al.* (1993), reported a case of dorsal coxofemoral luxation in a two months old male Sambar deer (*Cervus unicolor*). Luxation was corrected by closed method applying traction and counter traction under xylazine anaethesia. Fixation of the joint was effected by a butterfly cast with plaster of Paris. Eventhough the cast slipped off after 10 days the animal was able to bear weight on all the

limbs with slight limping. Later on limping disappeared and condition cured completely.

Minami *et al.* (1994), reported successful treatment of hip dislocation in a calf by translocation of greater trochanter to a more caudal and distal position than normal. The technique helped to stabilize the hip joint and prevent further luxation of joint.

Gopalakrishna *et al.* (1995) discussed an extra articular sling stabilization technique for treatment of coxofemoral luxation in dogs. After reduction, the hip joint was fixed using two bone screws looped with polypropylene tape placed cranial and caudal to acetabular rim. The ends of the thread were tied together through a hole drilled in the bony ridge dorsal to the neck of femur. Ninety two per cent success rate was reported. Reluxation was the complication noticed.

Godi *et al.* (1996) conducted experimental trials for fixation of reduced coxofemoral luxations using an extra articular sling with success. The hip joint was approached through a dorsolateral approach along with "L" shaped osteotomy of the greater trochanter. After correction of luxation, polypropylene tape was passed through two holes drilled; one from the lateral side to medial side just cranial to acetabulum on the body of ilium and another in horizontal plane at the base of trochanter and tied together in a figure of '8' fashion.

Materials and Methods

MATERIALS AND METHODS

Experimental animals

The study was conducted in 12 apparently healthy crossbred male calves of 6 to 12 months age and weighing between 60 and 80 kilogram. The animals were maintained under identical conditions of feeding and management. Animals were randomly divided into two groups, viz., Group A and B. Each group consisted of six animals, serially numbered from A1 to A6 and B1 to B6, respectively.

Preoperative preparation

All the animals were dewormed and kept under observation for one week prior to surgery. These animals were kept off feed for 12 hours prior to induction of hip luxation and 5% dextrose saline (500 was administered i/v prior to surgery.

Induction of coxofemoral luxation

Dislocation of the coxofemoral joint was induced on the left limb of all the animals. The animals were sedated using xylazine[1] at the dose rate of 0.2 mg/kg body weight administered intramuscularly. Ten minutes after

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1. Xylocad - 2% Cadila Laboratories, Ahmedabad

administration of xylazine, anterior epidural anaethesia was induced by injecting 2% lignocaine hydrochloride[2] solution through sacrococcygeal space. Animals were secured in right lateral recumbency. Stifle of the left limb was extended and the animal was brought into dorsal recumbency. In that position stifle was flexed and suddenly extended in posterior direction to induce posterior luxation. Dislocation was confirmed by an oblique ventrodorsal radiograph of the hip (Fig.1).

Preparation of site for surgery

The left gluteal region and thigh were shaved, washed with soap and water and scrubbed with cetrimide lotion[3]. The site was washed, mopped and painted with tincture iodine.

Instruments and materials

In addition to the general surgical instruments, following special instruments were used.

1. Hand drill and drill bit (3.8 mm x 10 cm)
2. Cortical screws (self tapping) 4.5 mm x 40 mm
3. Stainless steel wire (20 and 30 gauges)
4. Steinmann pins - 5 mm size
5. Ehmer Kirschner double clamps and extension rods

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2. Xylocaine 2% - Astra IDL Ltd., Bangalore
3. Suphalon Lotion -Southern Union Pharmaceuticals, Thrissur

Anaesthesia and control

Eighteen hours after induction of luxation, the animals were sedated using xylazine at the dose rate of 0.2 mg/kg body weight administered intramuscularly. Epidural anaesthesia was effected by injecting two per cent lignocaine hydrochloride solution through sacrococcygeal space. The animals were controlled in right lateral recumbency and draped. Sedation was maintained using diazepam[4] injection intravenously as and when it was needed.

Regional anatomy of the surgical site

The pelvic limb articulates by means of the head of femur with the lunate face of acetabulum. It is an enarthrosis (Ball and Socket joint) and cannot be considered as a free joint, since rotational and side to side movements are greatly restricted by the gluteal muscles and the thigh muscles.

Joint capsule is extensive and is attached to the neck of the femur and outer margin of acetabulum. The synovial membrane surrounds the ligament of the femoral head.

The acetabulum is formed by union of the three pelvic bones. It is hemispherical, directed backwards and to the

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4. Calmpose injection - Ranbaxy Laboratories Limited, New Delhi

sides. Shape of acetabulum is designed to match the head of femur and its associated ligaments. It has a ring like articular part, the *facies lunata*, which is covered by cartilage and a nonarticular roughened *fossa acetabuli* for ligamentous attachments. The level of the rim is raised by a cartilaginous rim, the *labrum acetabulae*, which is interrupted in the region of acetabular fossa by *incisura acetabuli* for the passage of ligaments. The acetabulum forms the socket of the joint.

The proximal part of femur, the *caput ossis femoris*, is hemispherical and projects medially. The head of femur has an articular part and a nonarticular part which is a depression at the centre of head for the attachment of *ligamentum teres*. The trochanter major lies lateral to the head and is higher than the head. Medial surface of trochanter is excavated forming the *fossa trochanterica*. Trochanter minor is located on the medial aspect of femoral shaft distal to the head of the femur.

The *ligamentum capitis ossis femoris* arises in the acetabular fossa and is enclosed by joint capsule. It runs through acetabular notch to be inserted on *fovea capitis*. The transverse acetabular ligament passes over the acetabular notch, holding the round ligament in position.

The muscles which activate the hip joint are numerous and generally very powerful.

Semitendinosus is a long fleshy fusiform muscle lying on caudolateral aspect of the rump. It originates from the caudo ventral surface of the ischiatic tuber along with the gluteobiceps. It gets inserted to the cranial border of tibia and fascia sorrounding the tendons of gastrocnemius and superficial digital flexor. It extends the hip joint and hock while flex the stifle and rotate the leg medially. Deep femoral and medial circumflex femoral arteries supply blood to the muscle.

Biceps femoris or gluteobiceps is a very expansive muscle situated in the lateral aspect of hip, thigh and superficial part of gluteus medius. It originates from sacral spine, sacrotuberal ligament, ischium, tuber ischii and gluteal fascia and gets inserted by a strong tendon cranially to the lateral patellar ligament, fascia latae, crural fascia, patella and cranial border of tibia. The action is to extend the stifle and hip joint as well as the hock. It extends the limb as in kicking and abduct the limb. Blood supply is from cranial and caudal gluteal, medial circumflex femoral, lateral circumflex femoral, caudal femoral and popliteal arteries.

Tensor fascia latae originates from the tuber coxae and strong fibrous tissue ventral to it and the gluteal fascia. It forms the cranial border of the thigh and gets inserted to fascia lata and femoral fascia. Its action is to tense the fascia lata, flex the hip, extend stifle joint and to abduct the limb. Blood supply is from deep circumflex iliac and lateral circumflex iliac arteries.

Gluteus medius, a thick fleshy muscle, filling the space between tuber coxae and great trochanter, is composed of large superficial head, the "gluteus medius" and a small deep head "gluteus accessorious". It originates at the dorsal and lateral sacro iliac and broad sacrotuberal ligament, gluteal surface of ilium and gluteal fascia. Superficial head gets inserted to the greater trochanter and trochanteric crest of femur. The deep head is inserted by a strong tendon into the femur distal to greater trochanter. Its action is to extend the hip joint, abduct the limb and rotate the femur. Blood supply is from cranial gluteal, deep circumflex iliac, medial circumflex femoral and lateral circumflex femoral arteries.

Gluteus profundus or deep gluteus is a fan shaped muscle over the hip joint. It originates from the tuber coxae, the body of ilium, ischiatic spine and sacrotuberal and sacro iliac ligaments. It gets inserted to the neck of femur near the greater trochanter and a strong tendon to the

craniolateral edge of greater trochanter. Action is to abduct the thigh and rotate it medially. Blood supply is from cranial gluteal and lateral circumflex femoral arteries.

Vastus lateralis is a part of the quadriceps femoris and originates from lateral surface of greater trochanter and caudolateral face of the femur. It gets inserted to lateral edge of patella and lateral patellar ligament. The action is to extend the stiffle joint. Blood supply is from lateral circumflex femoral and caudal femoral arteries.

Other structures seen in the region are the sacral part of lumbo sacral plexus which include cranial and caudal gluteal nerves and the ischiatic nerves (Getty, 1975 and Popesko, 1977).

Surgical technique

In animals of group A, open reduction and fixation of the luxated hip joint using stainless steel cortical screws and orthopaedic wire was performed.

In animals of group B dislocation was corrected by closed method and fixation was effected by closed method of pinning using steinmann pins.

Group A

Approach to hip joint

Hip joint was approached through a curvilinear incision just anterior to the trochanter major starting from 2.5 centimetre lateral to the mid dorsal line to the distal one-third of the femur (Fig.2). The apposition between the gluteo biceps and vastus lateralis was identified and separated by blunt dissection. Gluteobiceps was retracted posteriorly to expose greater trochanter and gluteus medius muscles.

The insertion of the gluteus medius was sectioned from greater trochanter and reflected anteriorly to expose the gluteus accessorius (deep head of gluteus medius) and deep gluteus (Nixon, 1994) (Fig.3).

Reduction of hip dislocation

Femoral head was elevated from the dislocated position using the body of a retractor holding at the level of greater trochanter. The acetabulum was cleared of blood clots and debris and the femoral head was pushed into the acetabulum with the thumb.

Retention of the femoral head

The femoral head was retained in the acetabulum by applying an extra articular sling using screws and stainless steel wires. Two holes 38 mm deep were drilled at the dorsal acetabular rim at 10 O'clock and 2 O'clock positions using a drill bit of size 3.8 mm. A third hole was drilled using the same drill bit on the femoral shaft below the greater trochanter. Three cortical self tapping screws of size 4.5 mm x 40 mm were driven into the holes already drilled (Fig.4). The acetabular set of screws were connected to the femoral screw separately, using stainless steel orthopaedic wires of size one mm (20 gauge) through a tunnel created beneath the deep gluteus, gluteus accessorius and the vastus lateralis (Fig.5). Care was taken not to damage the sciatic nerve which passes curving around the hip joint.

Closure of the incision

The transected tendinous insertion of the middle gluteus was refixed on to the greater trochanter using 30 gauge stainless steel wire (Fig.6). Gluteus medius and vastus lateralis muscles were apposed using braided silk. Skin incision was closed in vertical mattress pattern using monofilament nylon. Healex[5] was sprayed over the incision and the wound was sealed with cotton pad (Fig.7).

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5. Healex Spray - Rallis India Limited, Mumbai

Group B

Reduction of hip luxation

Reduction of hip luxation was carried out by closed method. For effecting this the limb was pressed at the stifle and taken anteriorly. The trochanter was pushed anteriorly with thumb so that the femoral head was relocated in the acetabulum. Correction of dislocation was confirmed by an oblique ventrodorsal radiograph of the hip joint.

Retention of the femoral head

Femoral head was fixed in position by driving two steinmann pins (5 mm size). The first pin was passed through wing of ilium in a posterior and downward direction and fixed on to the greater trochanter. The second pin was passed through point of ischium in a forward and downward direction and fixed on to the greater trochanter (Fig.8). The exposed ends of these pins were connected by steel rod of 5 mm size using Ehmer-Kirschner double clamps. The skin incision was closed in vertical mattress pattern using monofilament nylon. Healex was sprayed and a cotton pad was applied around the exposed portion of the pins (Fig.9).

The fixator assembly was retained in position for 21 days postoperatively.

Postoperative care and management

After surgery, all the animals were given ampicillin[6] injection intramuscularly at the dose rate of 10 mg/kg body weight twice daily for seven days. Phenyl butazone with analgin[7] five millilitre was administered for three days postoperatively as intramuscular injections. Dressing of the wound was done with povidone iodine ointment[8]. The animals were kept under observation for a period of 42 days postoperatively under identical conditions of feeding and management.

Physiological parameters viz., respiration rate, pulse rate and rectal temperature were recorded during the entire period of observation. Skin sutures were removed on 10th postoperative day. Animals were allowed restricted walking for three weeks postoperatively and there after free walking.

Haematology

Blood smears were prepared and blood samples were collected in citrated vials before and during anaesthesia and on postoperative days 1, 7, 14, 28 and 42 for studying:

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6. Stancillin - Sarabhai Chemicals,Baroda
7. Esgipyrin-N Sarabhai Chemicals, Baroda
8. Betadine - Win Medicare Ltd., New Delhi

1. Packed cell volume
2. Haemoglobin concentration (Acid Haematin Method)
3. Total leukocyte count and
4. Differential leukocyte count (Jain, 1986)

Radiographic studies

Oblique ventro dorsal radiographs of the hip joint were taken before and immediately after induction of hip dislocation and on 14th, 28th and 42nd days postoperatively. The radiographs were examined for any change in position of the femoral head, osteoarthritic changes, position of screws, wires and pins and for any soft tissue reactions.

Clinical evaluation

In all the animals the affected limb was observed while standing and during progression and for any change in the other limb. The main items of observation were:

a. General condition of animal

b. Symptoms of dislocation exhibited after induction of dislocation

c. Symptoms while standing
    1. Weight bearing
    2. Postural changes

d. Symptoms on progression

1. Weight bearing

2. Carriage of limb

Autopsy changes

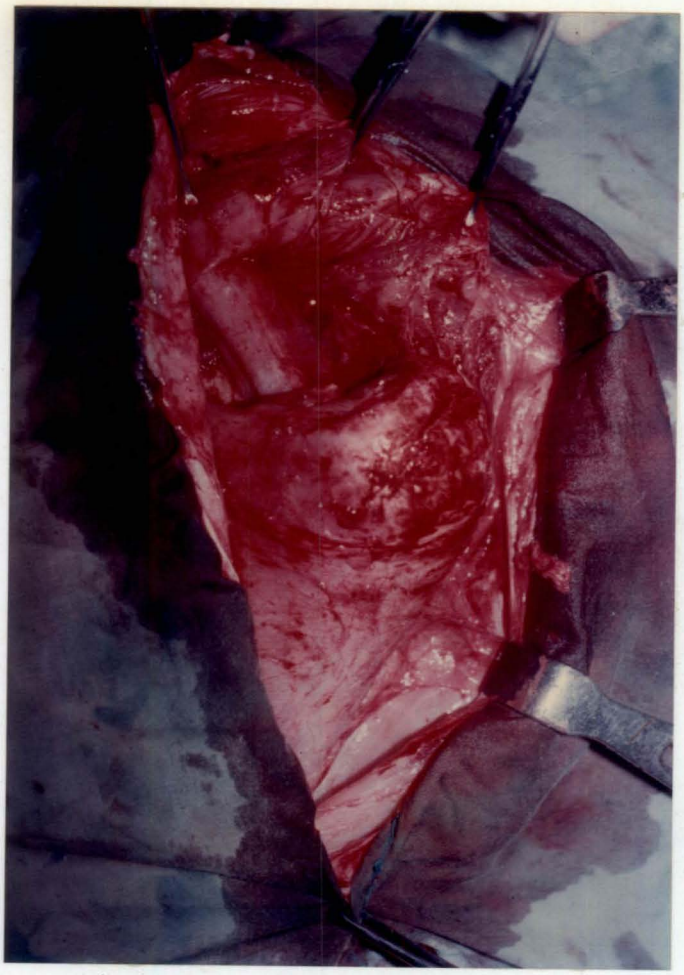
All the animals were sacrificed at the end of the period of observation. Detailed examination of the operated site was conducted to find out gross changes if any, in and around the region and on the metal implants.

Fig.1. Skiagram of a dislocated hip joint (Small arrow indicate the position of acetabulum and large arrow indicate position of the femoral head)

Fig.2. Photograph showing site of incision for surgical correction (Group A)

Fig.3. Photograph of hip joint after correction of dislocation (Group A)

Fig.4. Photograph showing screws in position for fixing wires (Group A)



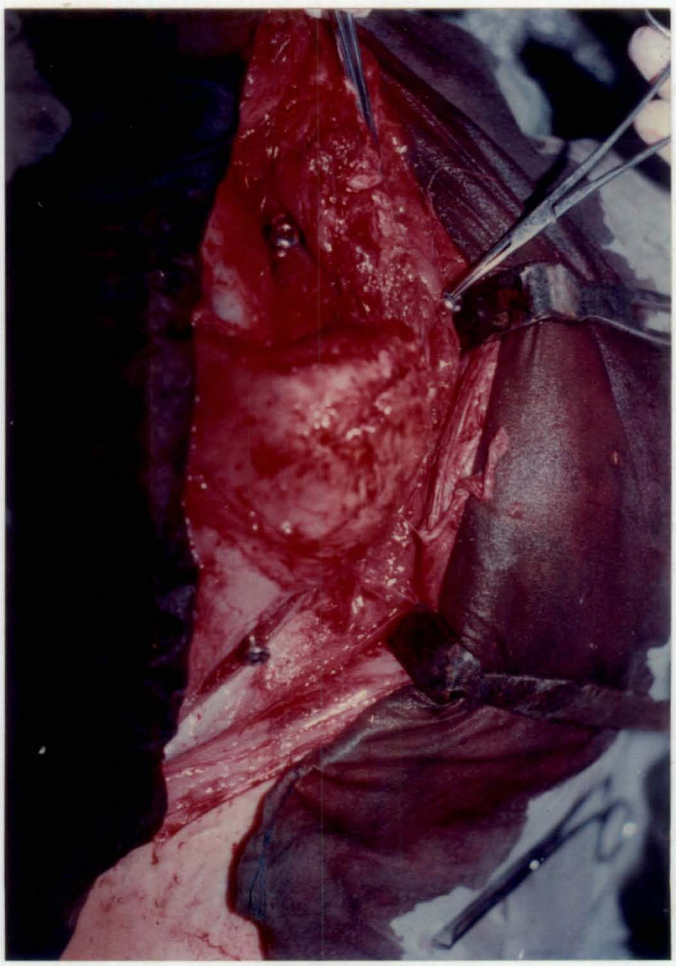


Fig.5. Photograph showing wires fixed to the femoral screw from the acetabular screws

Fig.6. Photograph showing fixation of the tenotomised gluteus medius to trochanter major

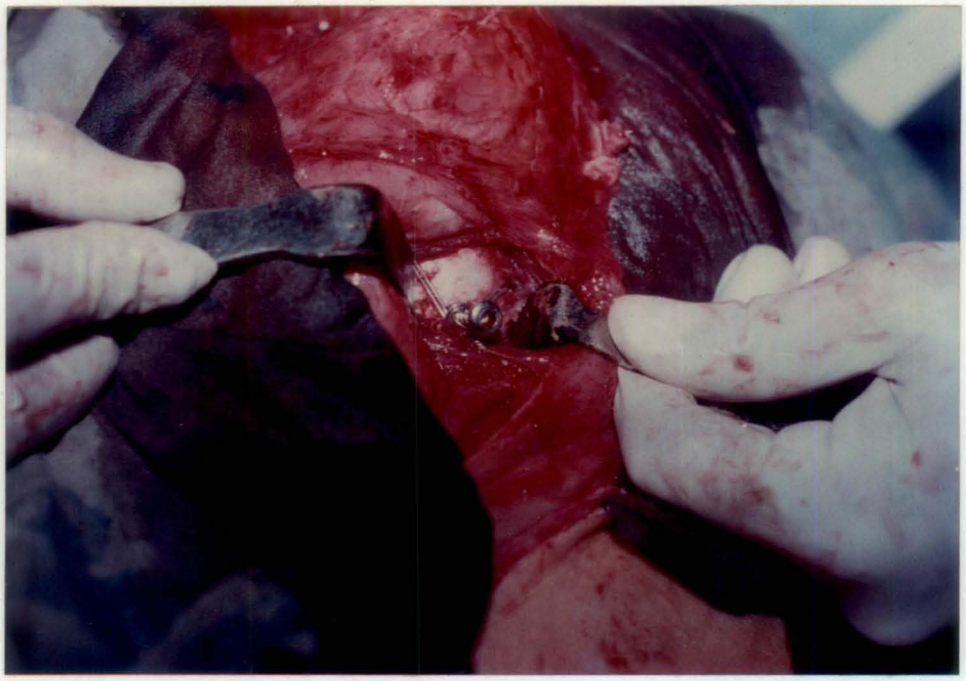
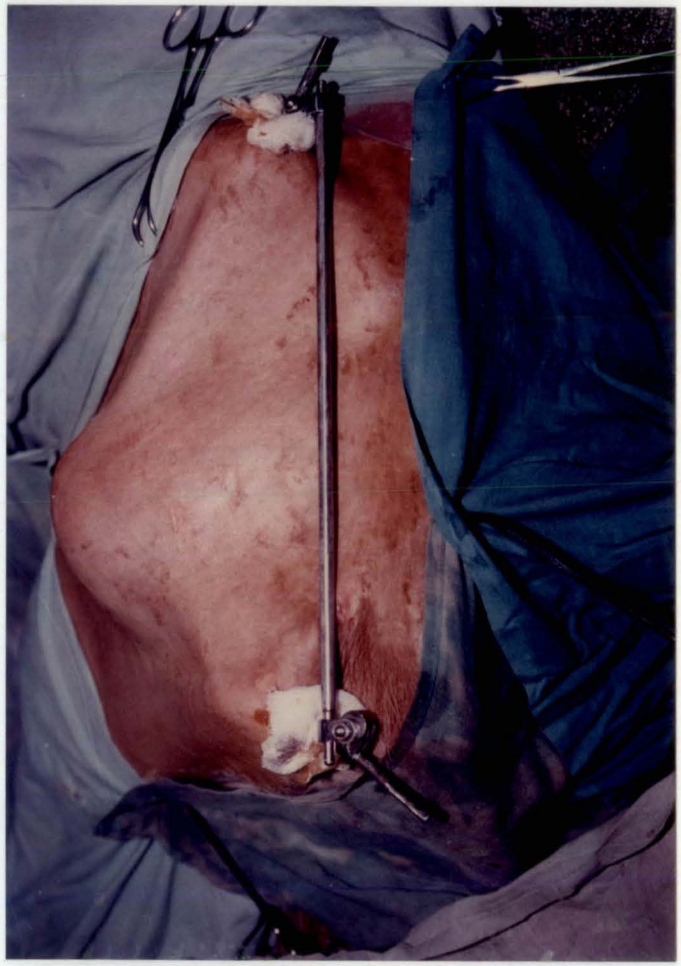


Fig.7. Photograph showing skin wound after completion of surgical correction (Group A)

Fig.8. Photograph showing site of insertion of pins (Group B)

Fig.9. Photograph showing fixator assembly applied after correction of luxation (Group B)



Results

RESULTS

The experimental study was conducted in twelve apparently healthy crossbred male calves randomly divided into two groups, A and B.

The mean body weight of animals in group A was 72.50 ± 3.35 kg and that of group B was 75.83 ± 2.00 kg (Table 1 and 2).

In all the animals, xylazine was administered intramuscularly to induce sedation and lignocaine hydrochloride was given epidurally for achieving anaesthesia of the hind limbs for inducing hip dislocation and for surgical correction. For prolonged surgical procedures, sedation was maintained with intravenous administration of diazepam.

Induction of dislocation

In all the animals, posterior dislocation of the head of the femur of the left hip was induced by manual traction and manipulation under deep sedation and epidural anaesthesia with the animal secured in right lateral recumbency. The luxation was confirmed in all the animals by an oblique ventrodorsal radiograph of the hip joint.

The symptoms of dislocation observed were an apparent increase in length of the luxated limb, flexion of the stifle joint and a posteriorly placed trochanter major when compared with the opposite normal limb. The distance between greater trochanter and point of ischium was found reduced and the distance between wing of ilium and greater trochanter was found increased. While standing and also during progression, the animals did not bear weight on the affected limb (Fig.10).

Table 1. Body weight, quantity of xylazine and lignocaine used for anaesthesia (Group A)

Sl. No.	Animal No.	Body weight (kg)	Quantity of xylazine used (@ 0.2 mg/kg) (mg)	Quantity of lignocaine used (ml)
1	A1	80	20	20
2	A2	60	12	15
3	A3	80	16	20
4	A4	65	13	20
5	A5	75	15	20
6	A6	75	15	15
Mean		72.50	15.17	16.67
SE		3.35	2.54	0.67

Table 2. Body weight, quantity of xylazine and lignocaine used for anaesthesia (Groups B)

Sl. No.	Animal No.	Body weight (kg)	Quantity of xylazine used (@ 0.2 mg/kg) (mg)	Quantity of lignocaine used (ml)
1	B1	80	16	10
2	B2	70	14	20
3	B3	70	14	15
4	B4	80	16	20
5	B5	80	16	20
6	B6	75	15	20
Mean		75.83	15.17	17.50
SE		2.00	0.40	1.71

GROUP A

In the animals of group A, dislocation was corrected by open reduction and fixation of the luxated hip joint was carried out using stainless steel cortical screws and orthopaedic wire.

Observations during surgery

An extensive skin incision was required to expose the hip joint. The technique required dissection of muscles and tenotomy of gluteus medius. Haemorrhage was minimum. The time taken for surgery in this group was 142.50 ± 4.42 min and mean period of recumbency was 195.0 ± 3.16 min (Table 3).

Since the joint was exposed, it was possible to remove the blood and fibrin clots accumulated in the acetabular cavity. Accurate reduction and a firm fixation was possible in this group.

Physiological parameters (Table 4)

Respiration

The respiratory rate (per minute) of 26.67 ± 0.84 before anaesthesia was found increased but within the normal range for first four postoperative days. It showed a gradual decrease to the normal value from fifth day onwards.

Pulse rate

Pulse rate (per minute) was 78.70 ± 2.56 before anaesthesia. An increase in pulse rate was observed upto sixth postoperative day which gradually decreased and became normal by tenth day.

Rectal temperature

Rectal temperature (°C) before anaesthesia was 38.32 ± 0.20. Slight increase in rectal temperature was observed in all the animals upto eighth postoperative day but the increase was not significant.

Haematology (Table 5)

Packed cell volume (PCV)

The packed cell volume (per cent) was 27.17 ± 2.69 before anaesthesia. It was found elevated during anaesthesia and on the first postoperative day. PCV was in normal range on seventh day and continued so during the remaining periods of observation.

Haemoglobin concentration

Haemoglobin concentration (g/dl) was 10.68 ± 0.41 before anaesthesia. A slight increase was observed during

anaesthesia but became normal on first postoperative day and remained in normal range through out the period of observation.

Total leukocyte count

The total leukocyte count ($x10^3/mm^3$) was 8.69 ± 0.83 before anaesthesia. It showed marginal increase throughout the period of observation but was within the normal range.

Differential leukocytic count

Neutrophil count

Neutrophil count (per cent) before anaesthesia was 31.33 ± 2.06. It showed significant increase upto seventh day, and decreased to become normal by 28th day and remained in normal range throughout the period of observation.

Lymphocyte count

The lymphocyte count (per cent) before anaesthesia was 66.83 ± 2.24. It showed significant reduction during anaesthesia and upto seventh postoperative day. It showed an increase by 14th day and was within normal range by 28th day.

Eosinophil count

The eosinophil count (per cent) which was 1.83 ± 0.80 before anaesthesia was seen slightly reduced during anaesthesia and a significant reduction was observed from the first postoperative day to the 42nd day of observation.

Clinical evaluation (Table 6)

General condition of animal

All the animals except animal (A3) were alert and active after recovery from anaesthesia till the end of observation. One Animal (A3) showed signs of colic on the 13th day.

. . Feed intake was normal in all the animals except animal A3. All the animals were able to get up and lie down with out assistance.

Symptoms observed on standing

Weight bearing

Complete weight bearing was seen in two animals (A1 and A2) on the first postoperative day and from second day onwards in three animals (A4, A5 and A6). In animal A3 it was seen by the fifth postoperative day (Fig.11) and subsequently all the animals showed normal weight bearing throughout the period of observation (Fig.12).

Pointing of toes

Pointing of toe while standing was seen for the first four postoperative days in animal A3 and on the first day, only in animals A4, A5 and A6.

Abduction of the limb

Abduction of the limb was seen in three animals, A3, A4 and A6. In A3 it was seen for the first three days and in A4 and A6 on the first postoperative day only

Rotation of the limb

Postoperatively, outward rotation of the limb was seen in four animals. In animal A3 for the first three days and in A5 and A6 for first two days. In A4 this symptom was seen on the first day only.

Observations during progression

Dragging of toe

Dragging of the toe was evident in animals A1, A2, A5 and A6 for the first three days of surgery. In A3 it was seen during the first four days and in A4 for first two days of surgery.

Weight bearing

Complete weight bearing was seen from fourth day in animals A1, A2, A5 and A6, from the fifth day in A3 and from third day in A4.

Swaying gait

Swaying gait was noticed for first six days in animal A1, four days in A2 and A3, three days in A5, A6 and for one day in A4.

Oedema at the surgical site

Oedema of the left gluteal and thigh region was seen for the first three days of surgery in animals A1, A2, A5 and A6, for four days in animal A4 and for five days in animal A3.

Skin wound

The skin wound showed complete healing by tenth day in all the animals and the skin sutures were removed.

Radiological evaluation

Oblique ventro dorsal radiograph of the hip joint on 14th, 28th and 42nd days after surgery revealed normal position of femoral head in the acetabulum in all the animals.

Osteoarthritic changes in the hip joint and acetabulum were not observed in any of the animals.

The screws and wires used for retaining the femoral head in acetabular cavity were in position (Fig.13) in all animals except in one (A6), where breakage of the steel wire was noticed on 14th day (Fig.14).

Autopsy findings

All the animals were sacrificed at the end of the observation period and the operated site was studied for gross lesions and structural changes.

Dissected portion of gluteobiceps showed good apposition. Wires and screws were found in correct position in all the animals except in animal A6. Joint capsule had healed completely and all suture materials were encapsulated by fibrous tissue. Tenotomised portion of gluteus medius showed good healing and apposition. Articular surfaces were smooth without any change in contour or size.

Table 3. Time of induction of sedation, duration of surgery and duration of recumbency in calves (group A)

Sl. No.	Animal No.	Time of induction of sedation (min)	Duration of surgery (min)	Duration of recumbency (min)
1	A1	7	150	195
2	A2	5	140	190
3	A3	10	160	210
4	A4	10	130	190
5	A5	10	135	195
6	A6	7	140	190
Mean		8.17	142.50	195.00
SE		0.87	4.42	3.16

Table 4. Physiological parameters observed before anaesthesia and during the first ten days after surgery (mean±SE) (group A)

n=6

Parameter	Day										
	0	1	2	3	4	5	6	7	8	9	10
Respiration rate (min)	26.67± 0.84	26.00± 1.64	26.00± 1.26	26.00± 1.26	26.00± 0.89	25.33± 1.78	25.67± 0.93	24.00± 0.55	24.00± 1.15	25.67± 0.93	25.00± 1.34
Pulse rate (min)	78.70± 2.56	98.30± 4.45	96.00± 6.11	84.00± 3.97	81.30± 3.41	83.00± 3.57	81.70± 3.48	77.30± 1.91	75.00± 3.17	77.00± 2.29	78.00± 2.68
Temperature (°C)	38.32± 0.20	38.45± 0.37	38.27± 0.28	38.37± 0.25	38.63± 0.24	38.55± 0.32	38.63± 0.31	38.58± 0.30	38.48± 0.14	38.30± 0.17	38.47± 0.10

Table 5. Haematological findings before anaesthesia, during anaesthesia and at different postoperative periods (group A) (Mean±SE)

n=6

Parameter	Day 0	During anaesthesia	Postoperative days				
			1	7	14	28	42
Packed cell volume (%)	27.17± 2.69	29.00± 2.04	* 31.50± 2.51	28.00± 2.05	28.40± 2.67	28.00± 2.43	28.60± 2.54
Haemoglobin (g/dl)	10.68± 0.41	10.80± 0.34	10.65± 0.39	10.68± 0.41	10.92± 0.41	10.62± 0.41	10.62± 0.41
Total leukocyte count ($x10^3/mm^3$)	8.69± 0.83	8.97± 0.69	10.27± 1.09	9.53± 0.58	9.88± 0.65	9.85± 0.74	9.81± 0.80
Neutrophil count (%)	31.33± 2.06	* 42.33± 2.95	* 52.50± 1.73	* 40.17± 2.59	31.40± 1.72	31.00± 1.26	30.60± 1.21
Lymphocyte count (%)	66.83± 2.24	* 56.00± 2.89	* 46.17± 1.72	* 59.00± 2.50	64.00± 1.70	66.60± 0.97	66.40± 1.16
Eosinophil count (%)	1.83± 0.80	1.67± 0.47	1.33± 0.04	0.83± 0.17	1.20± 0.38	1.20± 0.38	1.00± 0.45
Monocyte count (%)	0	0	0	0	0	0	0
Basophil count (%)	0	0	0	0	0	0	0

* ($P<0.05$)

Table 6. Clinical signs observed during postoperative days (from the day of surgery) (group A)

Sl. No.	Animal No.	On standing				During progression			Oedema at the site of surgery	Others
		Weight bearing	Pointing of toes	Abduction of limb	Rotation of limb	Dragging of toes	Weight bearing	Swaying gait		
1	A1	1-42	-	-	-	1-3	4-42	1-6	1-3	
2	A2	1-42	-	-	-	1-3	4-42	1-4	1-3	
3	A3	5-42	1-4	1-3	1-3	1-4	5-42	1-4	1-5	
4	A4	2-42	1	1	1	1-2	3-42	1	1-4	
5	A5	2-42	1	-	1-2	1-3	4-42	1-3	1-3	
6	A6	2-42	1	1	1-2	1-3	4-42	1-3	1-3	

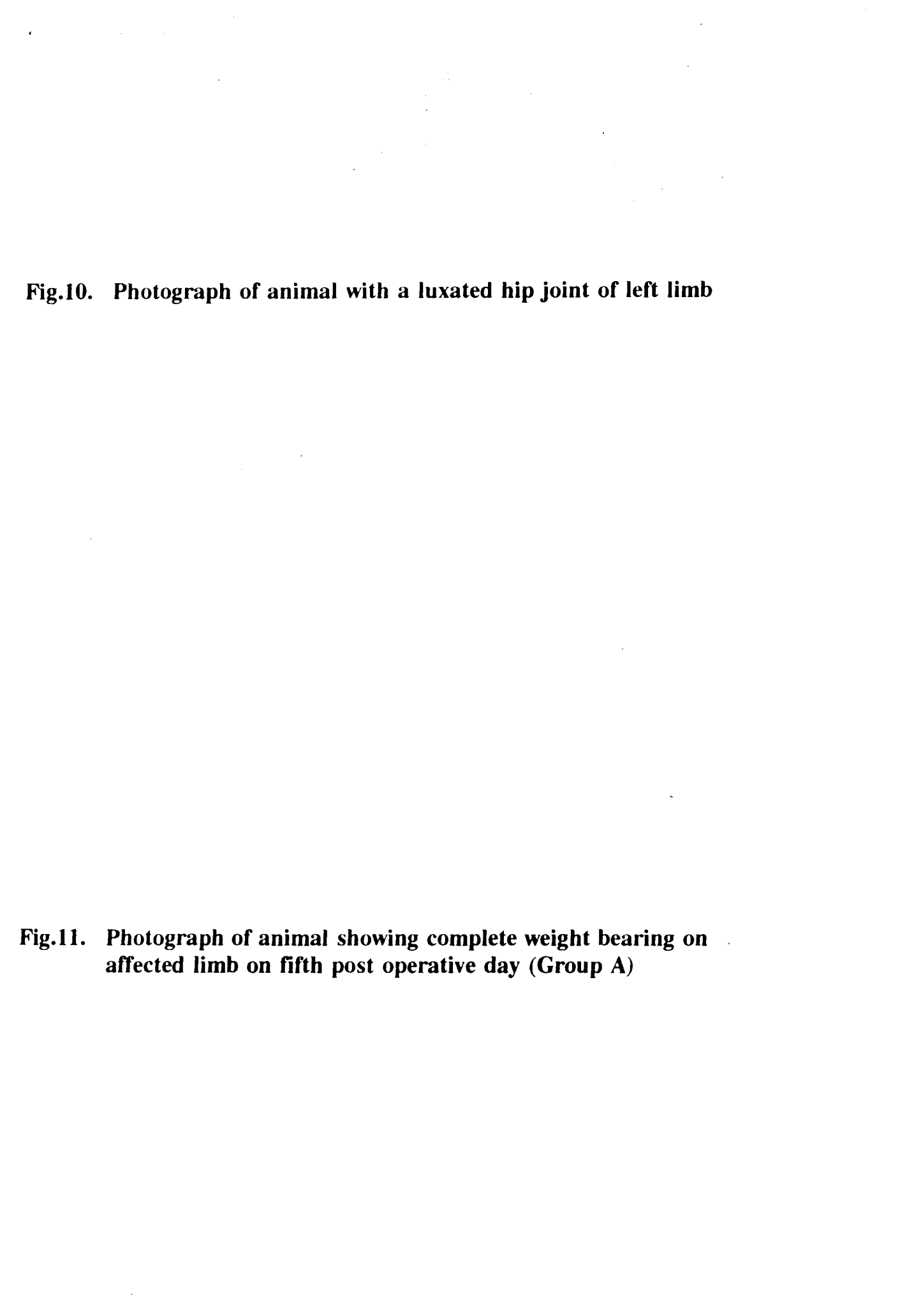


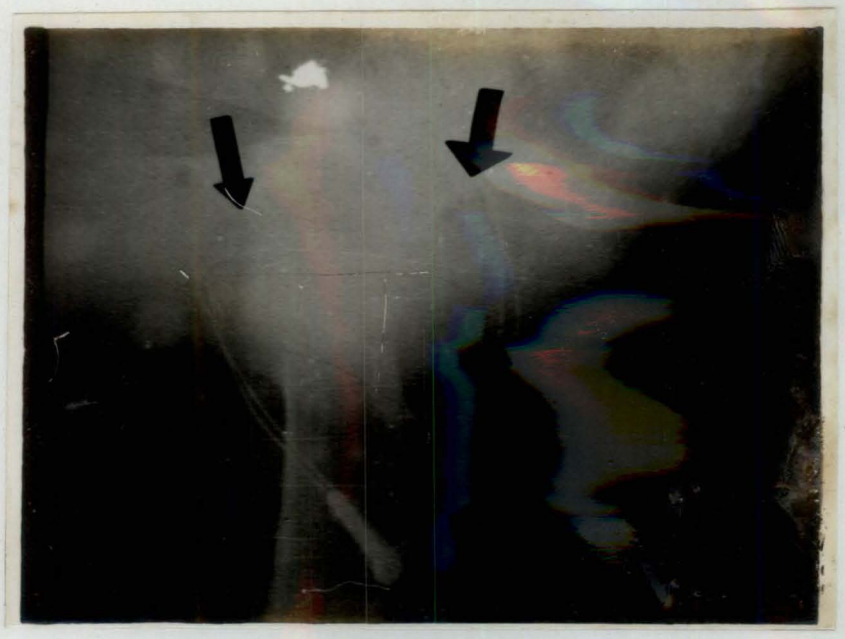
Fig.10. Photograph of animal with a luxated hip joint of left limb

Fig.11. Photograph of animal showing complete weight bearing on affected limb on fifth post operative day (Group A)

Fig.12. Photograph of animal on 42nd postoperative day showing normal weight bearing (Group A)

Fig.13. Skiagram showing position of screws and wires (Group A)


STAFF CAR



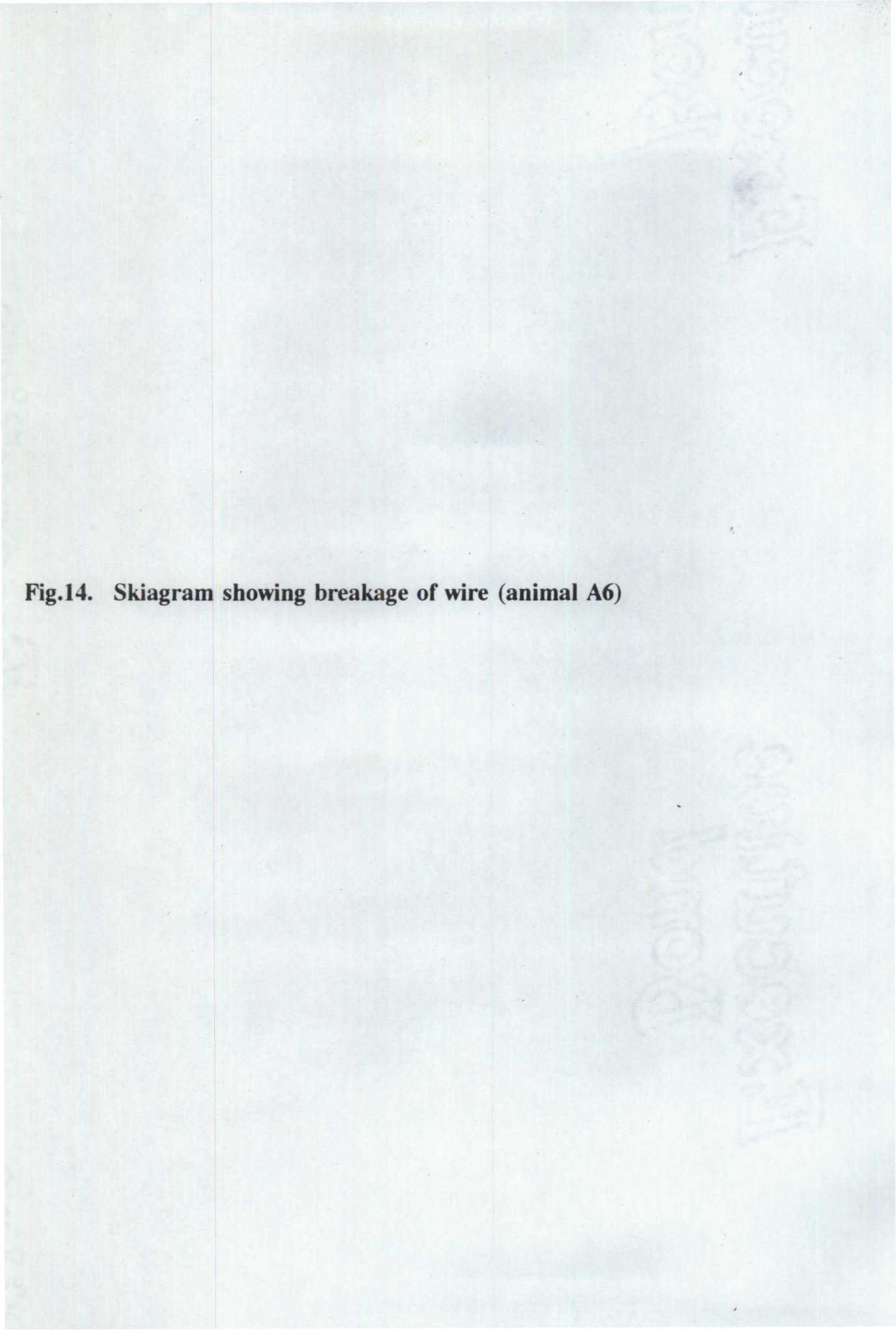


Fig.14. Skiagram showing breakage of wire (animal A6)

Group B

In the animals of group B, dislocation was corrected by closed method and fixation was effected by closed method of pinning using steinmann pins.

Observations during surgery

Reduction of the dislocated femoral head into the acetabulum by traction and local manipulation was easy. After closed reduction immoblization was effected by driving two Steinmann pins through the wing of ilium and point of ischium fixed at the greater trochanter in opposite direction. The outer ends of the pins were connected using an assembling steel rod and Ehmer Kirschner double clamps. A very small skin incision was only necessary for driving the pins. The technique did not involve dissection or sectioning of muscles. The time taken for surgery was 36.67 ± 2.47 minutes and mean duration of recumbency was 83.33 ± 3.80 minutes (Table 7).

An oblique ventrodorsal radiograph of the hip joint taken immediately after surgery revealed normal position of femoral head in the acetabulum and pins in position at the greater trochanter (Fig.15).

Physiological parameters (Table 8)

Respiration

The respiration rate (per minute) of 26.67 ± 0.99 before anaesthesia was found increased upto tenth day of surgery and thereafter remained in the normal range throughout the period of observation.

Pulse rate

The pulse rate (per minute) was 80.17 ± 4.03 before anaesthesia and an increase in rate was observed upto ninth day of surgery. Maximum pulse rate was observed on second postoperative day which gradually decreased and reached the normal range on the tenth day of surgery.

Rectal temperature

The rectal temperature (°C) was 38.60 ± 0.05 before anaesthesia and showed a marginal reduction during the first two days of surgery. From third day to fifth day the rectal temperature gradually increased and became normal by sixth day and remained in the normal range thereafter.

Haematology (Table 9)

Packed cell volume

The packed cell volume (per cent) was 32.51 ± 1.12 before anaesthesia. Slight increase in PCV was noticed during anaesthesia and a significant increase on the first postoperative day. On the seventh day PCV reached normal range and continued at the normal level thereafter.

Haemoglobin concentration

Haemolgobin concentration (g/dl) was 10.48 ± 1.06 before anaesthesia and remained in normal range throughout the period of observation.

Total leukocyte count

The total leukocyte count ($x10^3/mm^3$) was 8.86 ± 0.78 before anaesthesia. It showed an increase during the first postoperative day and became normal by seventh day. The variations were marginal and remained in normal range throughout the period of observation.

Differential leukocyte count

Neutrophil count

Neutrophil count (per cent) was 37.33 ± 0.92 before anaesthesia. It showed a significant increase during anaesthesia and on the first and seventh day of surgery. On fourteenth day the value became normal and later on remained in the normal range throughout the period of observation.

Lymphocyte count

The lymphocyte count (per cent) before anaesthesia was 61.33 ± 0.80. It showed a significant reduction during anaesthesia, and on the first and seventh postoperative days. On 14th day the value became normal and remained in the normal range thereafter.

Eosinophil count

The eosinophil count (per cent) before anaesthesia was 1.30 ± 0.42. An increase in the count was observed on the first day of surgery. The count became normal by seventh day and remained in the normal range thereafter.

Clinical evaluation (Table 10)

General condition of animals

The animals were alert and active throughout the period of observation after recovery from anaesthesia. Feed intake was normal. All the animals were able to get up and lie down without assistance.

In animal B1 the pins were found loose on the seventh day and had to be repositioned.

Symptoms observed on standing

Weight bearing

Complete weight bearing was seen from first day itself in animal B3. Four animals, B2, B4, B5 and B6 showed complete weight bearing on the third postoperative day and in B1 it was observed on the fourth day (Fig.16). From fourth day onwards all the animals showed complete weight bearing throughout the period of observation (Fig.17).

Pointing of toe

Pointing of toe was seen for three days postoperatively in animal B1 and in B2, B4, B5 and B6 it was seen for two days only.

Abduction of the limb

Abduction of limb was seen for first nine days post-operatively in animal B1, 10 days in B6, 13 days in B5, 14 days in B2 and 20 days in B3 and B4.

Rotation of the limb

Slight outward rotation of the limb was seen for first two days postoperatively in B2, three days in B5 and B6, five days in B1, six days in B4 and twenty days in B3.

Symptoms during progression

Dragging of toe

Dragging of toe was seen for first 20 days in B2, 21 days in B1 and B3, 22 days in B4 and B6 and for 23 days in B5.

Weight bearing

Complete weight bearing during progression was seen by 21 days in B2, 22 days in B1 and B3, 23 days in B4 and B6 and 24 days in B5.

Swaying gait

Swaying gait was present for 21 days in B1, for 22 days in B4 and B6 and for 23 days in B2, B3 and B5.

Oedema at the surgical site

Oedema at the left gluteal and thigh region was observed for the first four days of surgery in B1. In all other animals the symptom was noticed for the first three days of surgery only.

Skin wound

The skin wound through which the pins were introduced, healed without complication within ten days of removal of the pins.

Slight flexion of the fetlock joint and phalangeal joints of the left limb was noticed in animal B1 by seventh day after surgery and it persisted thereafter.

Animal B1 was found to have a mid shaft femoral fracture of the left limb due to a fall on the slippery floor on 23rd day of observation. The fracture was immobilised with intramedullary pinning using Kuentscher nail.

Animal B4 was having an increase in the slopping of pastern region of the opposite hind limb from the tenth day postoperatively and it persisted throughout the period of observation (Fig.18).

Radiological evaluation

Oblique ventro dorsal radiograph of the hip joint on 14th, 28th and 42nd days after surgery revealed normal position of femoral head in the acetabulum in all the animals. Osteoarthritic changes were not observed in any of the animals.

The radiographs on the 14th day revealed correct positioning of the pins in all the animals (Fig.19). Retention of femoral head in acetabulum was maintained till the end of the period of observation (Fig.20) in all the animals.

Autopsy findings

The animals were sacrificed at the end of the period of observation and the operated site was examined for gross lesions and structural changes.

Joint capsule had healed completely. The bony tract and tract on the muscle through which pins were introduced showed good healing. Articular surfaces were smooth without any abnormalities in contour or size.

Table 7. Time of induction of sedation, duration of surgery and duration of recumbency in calves (group B)

Sl. No.	Animal No.	Time of induction of sedation (min)	Duration of surgery (min)	Duration of recumbency (min)
1	B1	7	40	85
2	B2	6	35	75
3	B3	5	45	85
4	B4	8	30	75
5	B5	7	40	100
6	B6	8	30	80
Mean		7.00	36.67	83.33
SE		0.48	2.47	3.80

Table 8. Physiological parameters observed before anaesthesia and during the first ten days after surgery (mean±SE) (Group B)

n=6

Parameter	Day										
	0	1	2	3	4	5	6	7	8	9	10
Respiration rate (min)	26.67± 0.99	28.33± 2.33	28.67± 1.43	32.33± 3.48	29.00± 2.62	29.33± 1.61	30.00± 1.37	29.33± 1.98	29.00± 2.05	28.67± 2.98	27.17± 3.18
Pulse rate (min)	80.17± 4.03	89.33± 5.41	93.00± 8.03	89.83± 3.39	89.33± 4.67	83.50± 4.41	86.00± 5.24	83.33± 8.71	81.33± 9.50	82.00± 7.08	80.67± 4.83
Temperature (°C)	38.60± 0.05	38.42± 0.29	38.40± 0.31	38.63± 0.18	38.83± 0.19	38.77± 0.27	38.62± 0.28	38.63± 0.25	38.62± 0.55	38.67± 0.10	38.60± 0.23

Table 9. Haematological findings before anaesthesia, during anaesthesia and at different postoperative periods (Group B) (Mean±SE)

n=6

Parameter	Day 0	During anaesthesia	Day				
			1	7	14	28	42
Packed cell volume (%)	32.51± 1.12	34.17± 1.50	* 35.67± 1.61	31.00± 1.41	31.17± 1.14	31.60± 1.31	31.80± 1.02
Haemoglobin (g/dl)	10.48± 1.06	10.48± 1.06	10.50± 1.01	10.50± 1.06	10.48± 1.06	10.08± 2.20	10.08± 2.20
Total leukocyte count ($x10^3/mm^3$)	8.86± 0.78	8.99± 0.62	9.95± 1.17	8.48± 0.43	8.23± 0.62	8.56± 0.86	8.86± 0.96
Neutrophil count (%)	* 37.33± 0.92	* 43.67± 3.77	* 51.83± 1.80	41.00± 1.06	36.50± 1.54	37.00± 1.43	37.20± 1.07
Lymphocyte count (%)	61.33± 0.80	* 54.00± 3.62	* 46.33± 1.89	* 58.00± 1.03	62.17± 1.47	61.40± 1.21	61.40± 1.16
Eosinophil count (%)	1.30± 0.42	2.00± 0.58	1.83± 0.54	1.00± 0.26	1.33± 0.33	0.80± 0.37	0.40± 0.24
Monocyte count (%)	0	0	0	0	0	0	0
Basophyi count (%)	0	0	0	0	0	0	0

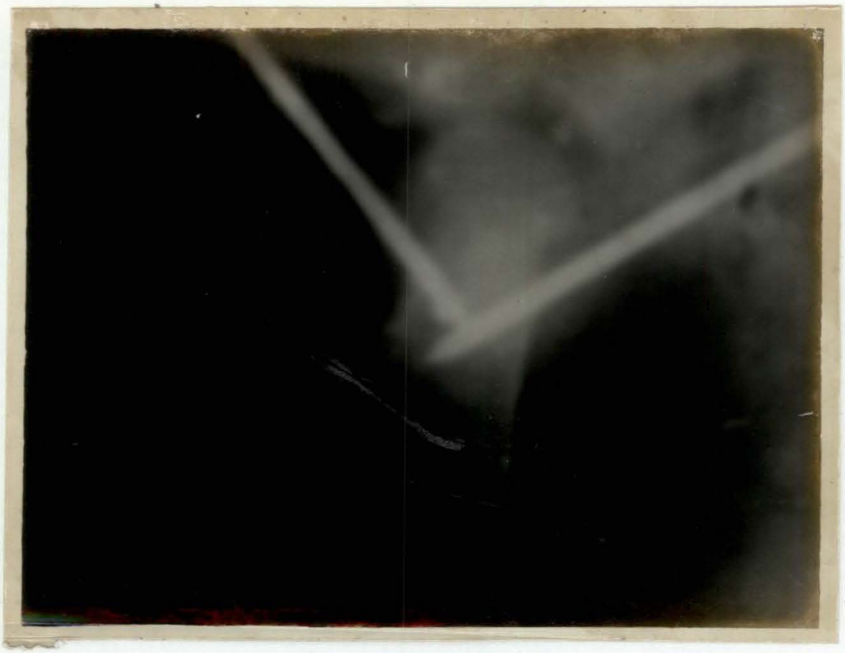
* $P<0.05$

Table 10. Clinical signs observed during postoperative days (from the day of surgery) Group B

Sl. No.	Animal No.	On standing				During progression			Oedema at the site of surgery	Others
		Weight bearing	Pointing of toes	Abduction of limb	Rotation of limb	Dragging of toes	Weight bearing	Swaying gait		
1	B1	4-42	1-3	1-9	1-5	1-21	22-42	1-21	1-4	Slight flexion of fetlock and phalangeal joint from 7th day
2	B2	3-42	1-2	1-14	1-2	1-20	21-42	1-23	1-3	
3	B3	1-42	-	1-20	1-20	1-21	22-42	1-23	1-3	
4	B4	3-42	1-2	1-20	1-6	1-22	23-42	1-22	1-3	Dropping of fetlock from 10th day
5	B5	3-42	1-2	1-13	1-3	1-23	24-42	1-23	1-2	
6	B6	3-42	1-2	1-10	1-3	1-22	23-42	1-22	1-3	

Fig.15. Skiagram showing position of femoral head in acetabulum and the pins at the greater trochanter immediately after surgery (Group B)

Fig.16. Photograph showing complete weight bearing on fifth day of immobilisation (Group B)



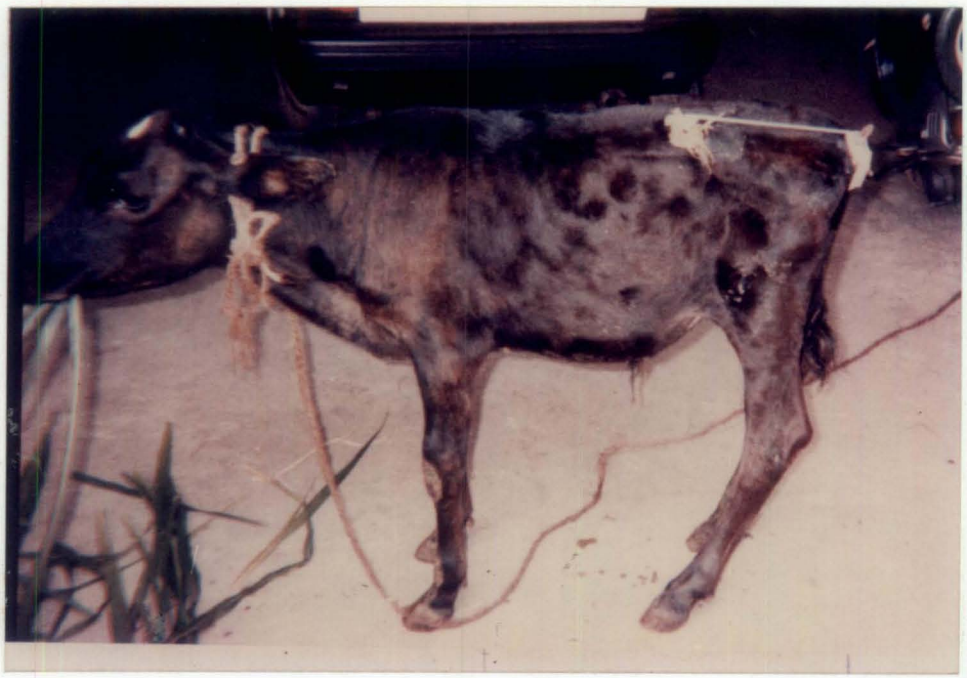


Fig.17. Photograph on 42nd postoperative day showing normal weight bearing (Group B)

Fig.18. Photograph (animal B4) with increased sloping of pastern of opposite limb

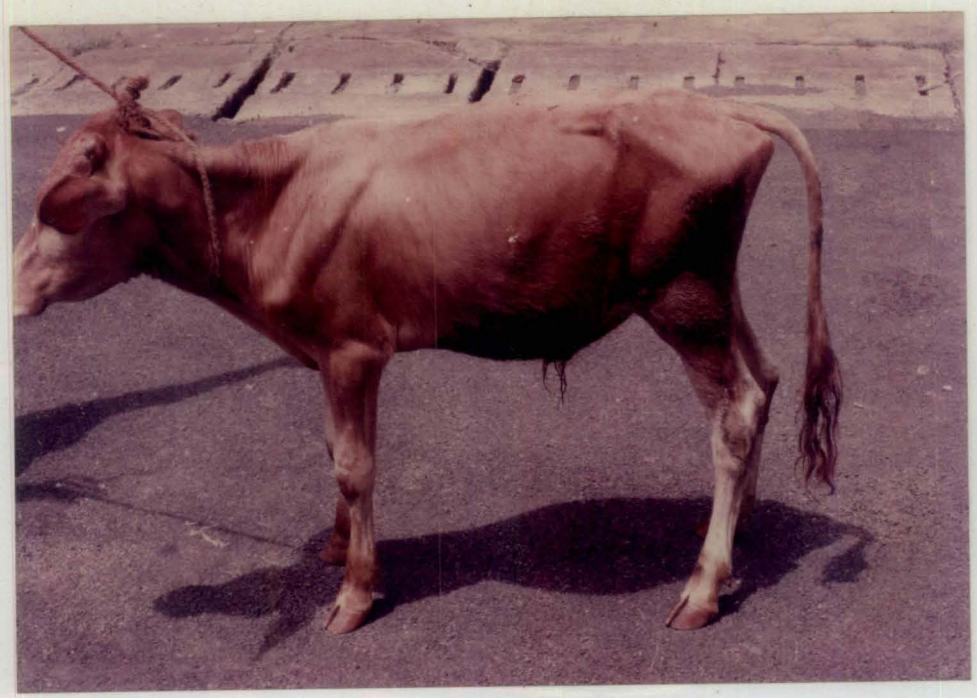


Fig.19. Skiagram of normal hip joint and properly positioned pins on 14th postoperaive (Group B)

Fig.20. Skiagram of hip joint on 42nd postoperative (Group B)

Discussion

DISCUSSION

The study was conducted in twelve apparently healthy male crossbred calves aged six to twelve months weighing between 60 and 80 kg with an objective of evolving a suitable technique for surgical management of coxofemoral luxation.

In all the animals, for inducing dislocation and for surgical correction, anaesthesia was achieved by sedation using two per cent xylazine combined with anterior epidural anaesthesia using two per cent lignocaine hydrochloride solution. Induction of hip dislocation could be effected under xylazine sedation along with anterior epidural anaestheaia. This procedure effected good sedation, muscle relaxation and analgesia throughout the period of surgery in group B. In group A, since the surgical procedure was time consuming and prolonged recumbency was needed, sedation had to be further extended with intravenous injection of diazepam

Xylazine hydrochloride intravenously have been satisfactorily employed during closed reduction of hip dislocation (Larcombe and Malmo, 1989). Epidural anaesthesia using Ravocaine has been tried by Rham (1959). Encouraging results has been reported by Godi *et al.* (1996) while using xylazine sedation along with anterior epidural block using two per cent lignocaine.

Surgical technique

In the animals of group A the hip joint was approached through a cranio lateral incision along with tenotomy of gluteus medius. This provided good visualization of the joint and correction could be effected with ease.

A cranio lateral approach to the hip joint for the correction and fixation of the luxated hip joint has been suggested by Adams (1957). He suggested this approach for drilling holes in the femur for the fixation of the luxated hip joint using a shuttle pin apparatus in cows.

Tulleners *et al.* (1980) approached the hip joint through a craniolateral incision with or without partial tenotomy of gluteus medius and suggested partial tenotomy for good visualization.

Pattanaik *et al.* (1990) compared dorsal approach with bisection of the gluteal muscles and dorsolateral approach along with trochanteric osteotomy. They found that for the treatment of coxofemoral luxation dorsolateral approach provided easy access and sufficient exposure.

Godi *et al.* (1996) reported good exposure of the hip joint through a dorso lateral approach along with "L" shaped osteotomy of the greater trochanter.

In the present study, after open reduction, the femoral head was fixed in position by the use of stainless steel screws and wires. The technique being extra articular, was simple, and did not require any special instruments. Since the articular surfaces were not manipulated, structural changes involving the joint were not observed. Similar results have been reported by Meij *et al.* (1992) in dogs and cats and Godi *et al.* (1996) in cattle.

In the present study, though the joint capsule was not sutured, good healing was observed in agreement with the observations of Godi *et al.* (1996).

The transected tendinous part of gluteus medius when refixed with the greater trochanter using stainless steel wire had healed without any complication. Tulleners *et al.* (1987) employed polyglactin 910 sutures in simple interrupted pattern for fixation of the tenotomised muscles.

The muscles which were apposed using 1-0 braided silk in simple continuous fashion showed good healing.

Cutaneous incision was closed in vertical mattress pattern using monofilament nylon. This produced accurate approximation of the skin edges with reduced tension. In all the calves, the wound had healed without any complication and the sutures were removed on the tenth postoperative day.

In group B, luxation was reduced in the closed method employing extension, counter extension and local manipulation of the femoral head. Fixation of femoral head in the acetabulum was achieved by inserting two Steinmann pins in opposite directions to the greater trochanter through the wing of ilium and tuber ischii. The exposed ends of these pins were connected by an assembling steel rod using Ehmer-Kirschner double clamps. This technique provided good retention and reluxation was not seen in any of the animals of this group till the end of the period of observation.

Even when the pins had slipped from the greater trochanter in one animal, reluxation had not taken place.

Larcombe and Malmo (1989) reported 75 per cent success rate for closed method of reduction in dairy cattle. Rham (1959) reported about a single case of treatment of hip luxation in cattle by the closed method.

Leonard (1964) suggested use of a half pin splint anchorage for the retention of femoral head in position after closed reduction of luxated hip joint in dogs and cats.

Observations during surgery

In group A, surgery was time consuming (142.5 ± 4.42 min) and the period of recumbency was prolonged (195.0 ± 3.16 min). Sedation had to be maintained using diazepam for the prolonged surgical procedure in this group.

The blood clots and tissue debris accumulated in the acetabular cavity could be removed in group A. This produced firm seating of femoral head in the acetabulum.

In animals of group B, surgery was easy to perform, less time consuming (34.67 ± 2.47 min) and the period of recumbency was 83.33 ± 3.80 min. Anaesthesia was satisfactory with single injection of xylazine and epidural injection of lignocaine hydrochloride 2 per cent solution.

Removal of blood clots and tissue debris from the acetabulum were not possible and the chance for reluxation is more after closed reduction (Tulleners, 1983). Reluxation could be prevented by proper fixation of femoral head in position. In the present study fixation achieved by the pins introduced was effective and recurrence of luxation was not

observed in any animal. The technique adopted was simple, less expensive and did not require any sophisticated equipments. Since the joint was not exposed in group B, chances for contamination and infection of the joint was very low.

Physiological observations

The respiration rate showed an increase within the normal range upto fourth postoperative day in group A and upto tenth day after surgery in group B.

Pulse rate showed an increase upto sixth day in group A and upto ninth day in group B.

Rectal temperature showed only a marginal variation during postoperative days in both groups.

The absence of variation in these parametrs indicated that there was hardly any systemic disturbance effected by the procedure.

Haematology

Packed cell volume was found increased in both the groups during anaesthesia and on the first postoperative day.

An increase within the normal range of the total leukocyte count was observed throughout the period of observation in Group A.

A slight increase in total leukocyte count was observed on the first day of surgery in group B.

Differential leukocyte count in both the groups revealed an increase in the neutrophil count upto seventh postoperative day and a corresponding decrease in lymphocyte count. These variation in haemogram was probably due to the inflammatory process consequent on surgical manipulations and during the healing of the surgical wound (Jain, 1986).

Clinical evaluation

All the calves of both the groups were alert and active after recovery from anaethesia. Feed intake was normal in all the calves. All the animals were able to get up and lie down without assistance.

Partial weight bearing of the affected limb while standing was observed in all the calves immediately after surgery. Complete weight bearing was seen in two animals in group A and one animal in group B from first postoperative day. In all other animals in both the groups complete weight

bearing while standing was accomplished by the fifth postoperative day.

In group A, pointing of toe was observed for the first four postoperative days in one animal and on first day of surgery in three animals.

In group B, pointing of toe was seen for first three days in one animal and for two days in four animals.

In group A, abduction of the limb observed for first three days in three animals disappeared by the fourth postoperative day.

When compared with group A, the symptom of abduction of limb was seen for a longer period in animals of group B. This symptom was seen for a period upto 20 days. The limb became normal after the removal of pins.

The outward rotation of the limb seen in all the animals of both groups was absent by sixth day except in animal B4 where it disappeared by twenty days.

Complete weight bearing during progression was accomplished by sixth day in all the animals of group A.

In animals of group B, complete weight bearing during progression was noticed after the removal of pin only.

Dragging of toe was also noticed for more days in animals of group B when compared to that of group A.

Swaying gait was also found for extended periods (upto twenty three days) in animals of group B when compared with that of group A (upto six days).

Oedema around the surgical site was noticed in all the animals of both groups during the first week of surgery. The oedema was probably due to the inflammatory process at the surgical site.

Slopping of the pastern region of the normal hind limb in one animal could be attributed to the excess strain consequent to uneven weight bearing during the postoperative periods (Ayyappan, 1981).

From the clinical signs observed it was noticed that, both techniques provided early ambulation and effective reduction of dislocation without causing any systemic reaction.

But in group B symptoms like abduction of the limb, dragging of toe and swaying gait were noticed for an extended period. Normal weight bearing during progression was accomplished only after the removal of pins. This might be due to the mechanical interference caused by the fixator

assembly since the symptoms were absent once the fixator was removed (Leonard, 1964).

Radiological evaluation

Oblique ventro dorsal radiograph was satisfactory for confirmation of hip luxation in all the animals.

Radiographs taken soon after surgery showed proper positioning of screws and wires and femoral head in acetabulum, in group A and proper positioning of pins in group B. Follow up radiographs taken during fourteenth, twenty eighth and forty second days also showed proper positioning of femoral head. There was no inflammatory change in the joint or articular surfaces.

Gross pathology of surgical site

In Group A, the healing of the muscles was good. Fixation of gluteus medius to the greater trochanter was found good and the steel wire was encapsulated. The screws and wires used for stabilization was encapsulated by fibrous tissue.

In group B joint capsule has healed completely. Local inflammatory changes were not noticed. Articular surfaces were smooth.

Radiographically no difference in healing pattern was seen. The femoral head was retained in the acetabular cavity throughout the period of observation. No inflammatory change could be noticed in the articular surfaces or the joint. Morphologically also the healing was satisfactory and without complications.

Assessing the two techniques it was seen that the surgical technique had not effected any complication or change in the joint. The treatment was satisfactory as the correction effected in hip luxation was comparable in the two techniques. However the advantages of the closed method were:

1. No surgical disection was needed.

2. Procedure was less time consuming

3. There was no chance of contamination and infection to the joint.

Hence the technique is reliable, safe and cost effective, and can be adopted under field conditions for the retention of femoral head in the acetabulum after closed method of reduction in hip dislocation.

Summary

SUMMARY

The study was conducted in 12 apparently healthy male crossbred calves aged six to twelve months and weighing 60 to 80 kg, randomly divided into two groups, A and B.

A posterior coxofemoral luxation of the left limb was induced by manipulation of the limb under sedation with xylazine hydrochloride along with anterior edpidural anaesthesia using lignocaine hydrochloride.

In group A, reduction of the luxated hip joint was achieved by open method through a cranio lateral approach. After reduction, retention of femoral head in the acetabulum was effected by an extra articular stabilization technique using cortical screws and orthopaedic wires.

In group B, reduction was effected by closed method with local manipulation of the femur and retention was effected by passing Steinmann pins through the wing of ilium and tuberischii in opposite directions. The pins were anchored at the greater trochanter and the exposed portions were fixed by means of an external connecting assembly.

In group A the technique required extensive skin incision and manipulation. Procedure was of longer duration. Reduction was accurate and easy and retention was effective.

In group B a very small skin incision just to drive the pins was only necessary. Procedure was simple and easy to perform. For the assessment of reduction, radiograph of the joint was taken.

There was an increase in respiration rate, pulse rate and rectal temperature in the animals of both the groups during the initial period of observation.

In all the animals of both the groups, the PCV values showed an increase from the preanaesthetic value during anaesthesia and on first day of surgery which became normal by seventh day.

Total leukocyte count in animals of group A showed a marginal increase from the preanaesthetic value throughout the period of observation. In group B the total leukocyte count was found within normal range throughout the period of observation.

Differential leukocyte count revealed neutrophelia and a corresponding decrease in the lymphocyte count upto 14th day of surgery in the animals of both the groups.

All the animals were alert and active and able to get up and lie down without assistance once they have recovered from anaesthesia.

Complete weight bearing while standing was accomplished by second day in group A and by fourth day in group B. One animal in group A showed weight bearing by fourth day only.

Dragging of toe was observed for four days in animals of group A and for 23 days in animals of group B. One animal of group B developed sloping of pastern of the normal limb by tenth day which persisted throughout the period of observation.

Radiography during the period of observation revealed normal position of femoral head in the acetabulum. Osteoarthritic changes in the hip joint were not noticed in any of the animals. Screws and wires were in position in all the animals of group A except one animal in which breakage of steel wire was noticed on the 14th day of surgery.

Healing of the wound at the surgical site was satisfactory in all the animals.

From the results of the present study it may be concluded that:

1. Xylazine hydrochloride administered intramuscularly at the dose rate of 0.2 mg/kg bodyweight along with anterior epidural block using 2% lignocaine hydrochloride produced optimum level of sedation, analgesia and muscle

relaxation for the surgical correction of hip dislocation in calves.

2. A cranio lateral approach (open reduction) to the hip joint followed by tenotomy of gluteus medius provided sufficient exposure and space for correction of luxation and stabilisation of femoral head using the extra articular screws and wires in calves.

3. Closed reduction followed by fixation of femoral head using Steinmann pins was found advantageous in hip dislocation. Since the joint was not surgically opened there was no chance for contamination and there was no inflammation of the joint.

4. Closed reduction followed by fixation with Steinmann pins was found to be a new, simple and cost effective technique for adoption under field conditions in the treatment of hip dislocation in calves.

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SURGICAL MANAGEMENT OF EXPERIMENTALLY INDUCED COXO-FEMORAL LUXATION IN CALVES

By

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ABSTRACT OF A THESIS

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ABSTRACT

The present study was conducted to evolve a suitable technique which can be adopted under field conditions for the management of coxofemoral luxation in calves and to compare the efficacy of open and closed reduction in the treatment. The study was conducted in 12 male crossbred calves in which coxofemoral luxation was induced under anaesthesia. Two methods of treatment were adopted in two groups of six animals each. In one group open reduction was performed under anaesthesia and the femoral head was fixed in position by the application of an extra articular sling using cortical screws and orthopaedic wires. In the second group, after closed reduction under anaesthesia, immobilisation was effected by the fixation of two Steinmann pins at the greater trochanter through the wing of ilium and tuber ischii and connecting the exposed portions of the pins by an external connecting assembly.

All the animals were able to get up and lie down without assistance after correction and partially bear weight on the operated limb from the day of surgery itself. Complete weight bearing while standing was noticed in all the animals in two to four days time. Dragging of toe was observed upto fourth day in animals in which open reduction was performed whereas in other group it was observed upto 23 days.

The difficulty encountered in closed reduction group was the inability to identify the status of reduction for which radiograph was taken. Open reduction with immobilisation using screws and wires produced firm seating of femoral head in the acetabulum.

The respiration rate, pulse rate and rectal temperature showed an increase within the normal range in all the animals. Variations in haematological values were indicative of stress and inflammation subsequent to surgery. Radiographic studies during the period of observation confirmed the position of femoral head in the acetabulum and the absence of recurrence. Gross morphological examination of the hip joint revealed satisfactory healing and absence of local complications.

The technique of closed reduction along with external fixation was satisfactory for reduction and immobilization in coxofemoral luxation in calves.