4. Results

4.1. General results.

There were 140 horses (105 Warmbloods, 16 Standardbreds, 15 Thoroughbreds, 2 Ponies, 1 Quarter Horse and 1 Arabian; 56 geldings, 35 intact males and 49 females), 1 to 18 years of age, that met the criteria for inclusion in this study. A total of 158 phalangeal joints underwent successful fluoroscopic guided minimal invasive surgery in the Equine Clinic, Free University of Berlin.

The horses presented either with an established diagnosis by a referring veterinarian or lameness evaluation and subsequently diagnosed at our clinic. Some cases were incidentally detected during prepurchase radiographic examination.

No complications related to the anesthetic period such as respiratory complications (pleuroneumonia) were encountered in the postoperative period and no intraoperative complications were encountered.

Dosimeters were evaluated every month by the official administration for radiation measurement in Berlin (Senatverwaltung für Stadtentwicklung Strahlenmeßstelle Berlin). The estimated irradiation doses for the surgeons and each person incorporated in the operation theater per year were very low and not exceed the legal limits permitted in Germany (Table 1)

Table 1: X-ray exposure (mSv) in the operating room during one year (2003) in comparison with the maximum permissible dose (MPD).

	Under apron dosimeter	MPD	Finger dosimeter	MPD
Orthopaedic surgeon	0.5	20 mSv/year	1.24	500 mSv/year
Assistant surgeon	0.6		1.61	
Anesthetist	0		0	

4.2. Surgical removal of isolated shadows from the region of the common digital extensor tendon (CDET) insertion at the extensor process of the third phalanx (28 horses).

Twenty eight horses were underwent fluoroscopic guided surgery for removal of isolated shadows from the region of the CDET insertion at the extensor process of the third phalanx. Twenty seven (97%) of 28 were Warmbloods, whereas 1 (3%) was Thoroughbred. Twenty were castrated males, 3 was sexually intact male, and 5 were females. Twenty horses were > 5 years old; mean age was 7 years and range was 2 to 12 years .The right forelimb was affected in 15 horses and the left forelimb was affected also in 15 horses. In two horses, the lesion was bilateral (Table 2).

Of these 28 horses, 5 showed no lameness and 23 were lame before surgery. The indication for surgery in the 5 horses that were not lame was prophylactic and the isolated shadows incidentally detected during the prepurchase radiographic examination. Fourteen horses were referred with a history of chronic lameness (> 30 days) and among these horses 3 had duration of lameness > 2 year. Lameness was scored on a 5-point scale (Annon 1991) and lameness grade ranged from mild to moderate degree (1 to 2 of scale 5). Lameness grades were mild for 18 horses and moderate for 5 horses. Only in one horse, a moderate distension of the hoof joint was observed during palpation of the joint (horse No. 15). Fetlock-phalangeal flexion test was performed in 26 horses and was impossible in two horses. Nine horses showed no lameness, 3 horses showed doubtful (not clear) positive results, 9 showed mild positive results and 6 showed moderate positive results. Responses to perineural analgesia of the palmar digital nerve at the proximal sesamoid bone were recorded in 19 horses; substantial improvement in lameness (positive result) was detected in 16 horses and another 3 horses showed no response (negative result) to the perinural analgesia (Table 3).

Isolated shadows within the region of the extensor process of the third phalanx were best visualized on lateromedial radiographic projections. Thirteen horses had findings suggested that the fragment was of chronic duration (lucency of fracture margins and bony proliferation on the dorsal aspect of the distal phalanx along the attachment of the CDET) **(Fig. 1)**, and 3 horses had mild radiographic evidence of osteoarthritis (roughening of the dorsal articular margins of the distal phalanx and distal portion of the 2nd phalanx). Two horses with a history of chronic lameness appeared to have multiple radiopaque bodies within the region of the extensor process of the third phalanx **(Fig. 2)**.

The size of the isolated shadows was also best evaluated on a lateromedial radiograph. Radiopaque body up to 6 mm was considered small and up 7 mm was considered large. Of these 28 horses18 had large isolated shadows and 10 had small ones (Table 4; **Figs 1 &3**).

The shape, contour, and location of these isolated shadows varied from round to triangular shape, from sharp regular to diffuse irregular contour, and from none displaced (with direct location on the third phalanx)) to displaced (with proximal dislocation) **(Figs.1, 2, 3, 4, and 5)**

Fife horses had concurrent lesions in the same limb, 4 of them concurrently operated with the aid of fluoroscopy (Table 5)

Table 5: showing the horses that had concurrent lesions in the same limb and the method of their treatment.

Horse No.	Type of concurrent affection	Type of treatment
2	Apical fracture of the lateral proximal sesamoid bone.	Surgical removal at the same time under fluoroscopic guidance.
9	Proximal sesamoid bones exostosis.	Conservative management
15	Subchondral bone cyst at the distal end of the 2nd phalanx.	Surgical management at the same time under fluoroscopic guidance.
18	Isolated shadow at the proximal dorsal aspect of the fetlock joint.	Surgical extirpation under fluoroscopic guidance.
25	Isolated shadow at the proximal dorsal aspect of the fetlock joint.	Surgical extirpation under fluoroscopic guidance.

From the technical point of view all the operations were easily performed and no intraoperative complications encountered. In some cases the radiopaque bodies were buried within the CDET, reactive tissue, or joint capsule which makes their retrieval difficult especially if they are chronic.

The actual exposure times of the fluoroscopy imaging C-arm device were recorded during 15 operations and the range was 1-6 minutes (median time was 3 minutes).

During the period immediately after surgery, 2 horses had substantial discomfort and were reluctant to bear weight on the affected limb. Whereas the other horses did not have evidence of discomfort that exceed that detected before surgery (i.e., willing to bear weight on the affected leg and move easily around the stall).

All horses have cleaned and dried incision line at the initial bandage change. After 2-3 days postoperatively the elastic adhesive bandage was replaced with half-limb bandage and at all bandage changes, swelling was not detected within the joint or around the operative site. At 10 days after surgery all sutures were removed.

All cases that were originally lame before the operation injected intra-articulary with hyauronan.

All horses were radiographed postoperatively and again within a period of 6 weeks post surgery. Radiographs did not reveal any productive bone changes (periosteal reactions) resulting from surgery. Postoperative radiograph revealed incomplete removal of the radiopaque body in 9 cases (Table 6). Of these 9 cases, 8 showed small rest bodies **(Figs 6&7)** and one case showed a large rest radiopaque body. Of these rests radiopaque bodies, 3 cases were not recognized in the final postoperative fluoroscopic image. Four horses of these 9 cases were reoperated; horse No. 19 had a large rest body which was completely removed after one month; horse No.2 after 1 years, the rest body was developed to a very large one with the signs of lameness and a second operation was performed with incomplete removal of the isolated body; Horse No. 6 also developed a large isolated body after one year which completely removed; horse No. 24 developed a large isolated body after 6 months with recurrent signs of lameness which incompletely removed **(Fig.7)**.

Table 6: Showing the result of postoperative radiographs, fluoroscopy image, and the result of the 2nd operation in the cases that had incomplete removal of the radiopaque bodies.

Horse NO.	Postoperative radiographs	Postoperative fluoroscopy image	2nd operation
2	Small pieces rest	Observed	After one year Incompletely removed
6	Small piece rest	Not observed	After one year Completely removed
8	Very small piece rest	Not observed	
12	Small pieces rest	Observed	
14	Small pieces rest	Observed	
16	Small piece rest		
19	Large piece rest	Not observed	After one month Completely removed
23	Small piece rest	Observed	
24	Small piece rest	Observed	After 6 months Incompletely removed

The fife horses that were not lame prior to surgery were put back into work 2 weeks after surgery and all of them were without lameness. The 23 horses that were lame prior surgery started training 8-10 weeks after surgery.

Follow up information was obtained for 24 horses, twenty of 24 horses had successfully returned to their previous use at a level of performance equal to or greater than their performance. Four of 24 horses had unsuccessful outcomes. They were described as improved, but not sound, and the owners were pursuing adjunctive treatments to further improve the horse soundness.

Table 2: Age, breed, sex, and the affected limb of the horses subjected to fluoroscopic guided surgical removal of isolated shadows (radiopaque bodies) from the region of CDET insertion at the extensor process of the third phalanx.

Horse No.	Age/year	Breed*	Sex	Affected limb†
1	5	WB	G	RF
2	4	WB	G	RF
3	11	WB	F	RF
4	4	WB	G	LF
5	3	WB	G	RF
6	10	WB	G	LF
7	10	WB	G	RF
8	7	WB	G	RF
9	7	WB	G	LF
10	7	WB	G	RF
11	9	WB	F	RF
12	10	WB	G	RF
13	2	WB	M	LF
14	7	TB	G	LF
15	10	WB	G	LF&RF
16	11	WB	G	RF
17	6	WB	F	LF
18	2	WB	G	LF
19	4	WB	F	LF
20	12	WB	G	RF
21	4	WB	G	RF
22	9	WB	G	LF
23	6	WB	F	RF
24	8	WB	G	LF
25	6	WB	G	LF
26	8	WB	G	LF
27	2	WB	M	LF&RF
28	2	WB	M	LF

* WB= Warm blooded; TB= Thoroughbred
§ G= Gelding; F= Female; M= Male
† RF= Right front; LF= Left front

Table 3: Lameness character, Lameness grade, result of fetlock phalangeal flexion test, and the result of perineural analgesia of the palmar digital nerve at the base of the proximal sesamoid bone.

Horse No.	Lameness Character	Lameness grade	Joint flexion test.*	Perineural analgesia.
1	Chronic	Moderate degree	++	Positive
2	Chronic	Mild degree	+	Positive
3	Acute	Mild degree	++	Positive
4	No lameness	No lameness	-	Not performed
5	Acute	Moderate degree	++	Not performed
5	Chronic	Mild degree	+	Positive
7	Chronic	Mild degree	-	Positive
8	Chronic	Mild degree	-	Positive
9	Chronic	Moderate degree	++	Negative
10	Acute	Moderate degree	+	Positive
11	Acute	Mild degree	+-	Positive
12	Chronic	Mild degree	+	Positive
13	Acute	Mild degree	Not possible	Not performed
14	Chronic	Mild degree	-	Positive
15	Acute	Mild degree	-	Negative
16	Chronic	Mild degree	+-	Positive
17	No lameness	No lameness	-	Not performed
18	Acute	Mild degree	+	Negative
19	Chronic	Mild degree	+	Positive
20	Chronic	Mild degree	+	Positive
21	Chronic	Moderate degree	++	Not performed
22	Acute	Mild degree	-	Positive
23	Chronic	Mild degree	+	Positive
24	Chronic	Mild degree	+	Positive
25	No lameness	No lameness	+-	Not performed
26	Acute	Mild degree	++	Not performed
27	No lameness	No lameness	Not possible	Not performed
28	No lameness	No lameness	-	Not performed

* - = No lameness; +- =Not clear lameness; + =Mild degree; ++ = Moderate degree of lameness.

Table 4: Size (radiographic and after their removal), character, postoperative radiographic appearance of isolated shadows that were removed from the region of the extensor process of the third phalanx.

Horse No.	Radiographic Size	Character	Postoperative Size	Postoperative radiograph
1	Large	Free and movable	Pea-size	Completely removed
2	Large	Fixed (attached)	Multiple small pieces	Incompletely removed
3	Large	Fixed (attached)	Pea-size	Completely removed
4	Small	Fixed (attached)	Cherry seed-size	Completely removed
5	Small	Free and movable	Cherry seed-size	Completely removed
6	Large	Fixed (attached)	3 pieces cherry seed-size	Incompletely removed
7	Large	Fixed (attached)	2 pieces pea-size	Completely removed
8	Large	Fixed (attached)	Multiple small pieces	Incompletely removed
9	Small	Free and movable	Cherry seed-size	Completely removed
10	Large	Fixed (attached)	Pea-size	Completely removed
11	Large	Free and movable	Bean-size	Completely removed
12	Large	Free and movable	Pea-size	Incompletely removed
13	Small	Free and movable	Lentil-size	Completely removed
14	Large	Fixed (attached)	2 pieces pea-size	Incompletely removed
15	Large	Free and movable	Pea-size	Completely removed
16	Large	Fixed (attached)	Multiple small pieces	Incompletely removed
17	Large	Fixed (attached)	Multiple small pieces	Completely removed
18	Small	Free and movable	Pepper seed-size	Completely removed
19	Large	Fixed (attached)	2 pieces pea-size	Incompletely removed
20	Large	Free and movable	Pea-size	Completely removed
21	Small	Fixed (attached)	Cherry seed-size	Completely removed
22	Small	Free and movable	Cherry seed-size	Completely removed
23	Large	Fixed (attached)	3 pieces (2 pea-size and one lentil-size)	Incompletely removed
24	Large	Fixed (attached)	3 pieces cherry seed-size	Incompletely removed
25	Small	Free and movable	Cherry seed-size	Completely removed
26	Large	Free and movable	2 pieces pea-size and cherry seed-size	Completely removed
27	Small	Fixed (attached)	Pea-size	Completely removed
28	Small	Free and movable	Pea-size	Completely removed

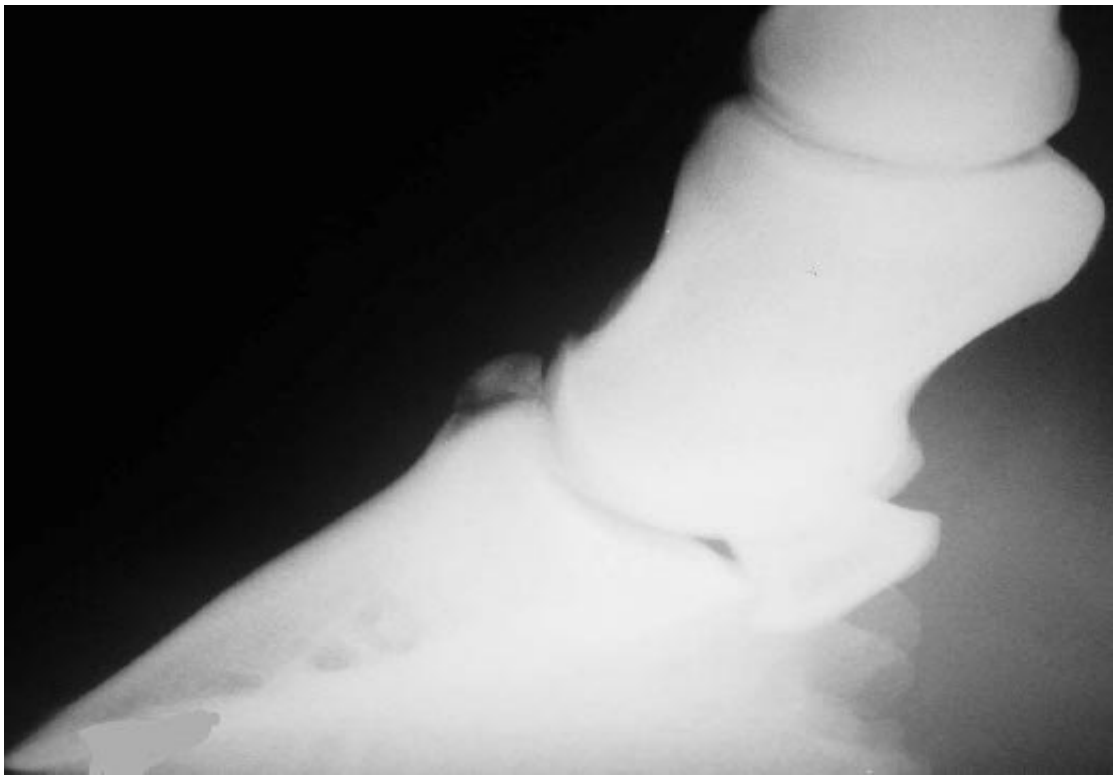

Fig. 1: Lateromedial radiograph showing a large triangular radiopaque body proximal to the extensor process of the distal phalanx. Note the lucency of the fragment margins and bony proliferation on the dorsal aspect of the distal phalanx along the attachment of the CDET.

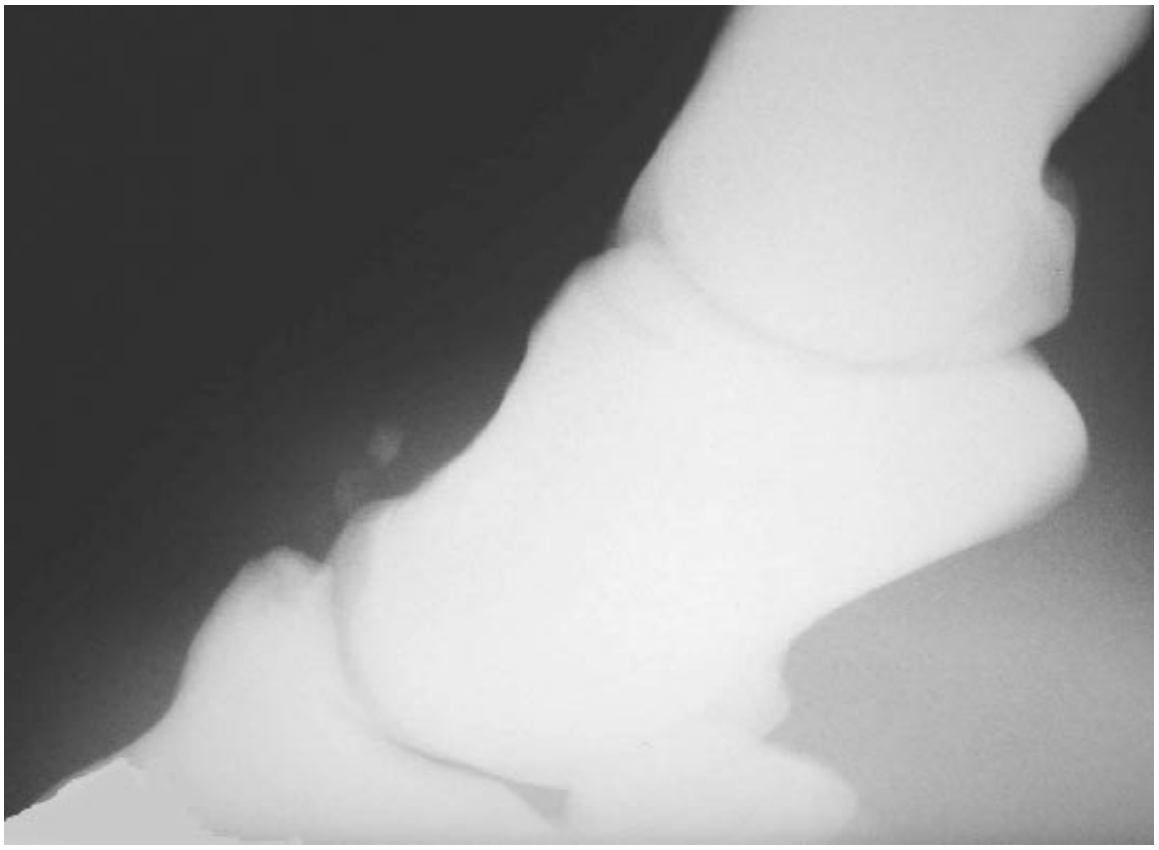

Fig. 2: Lateromedial radiograph showing 2 radiopaque bodies proximal to the extensor process of the distal phalanx. Note the fragments were displaced proximally.

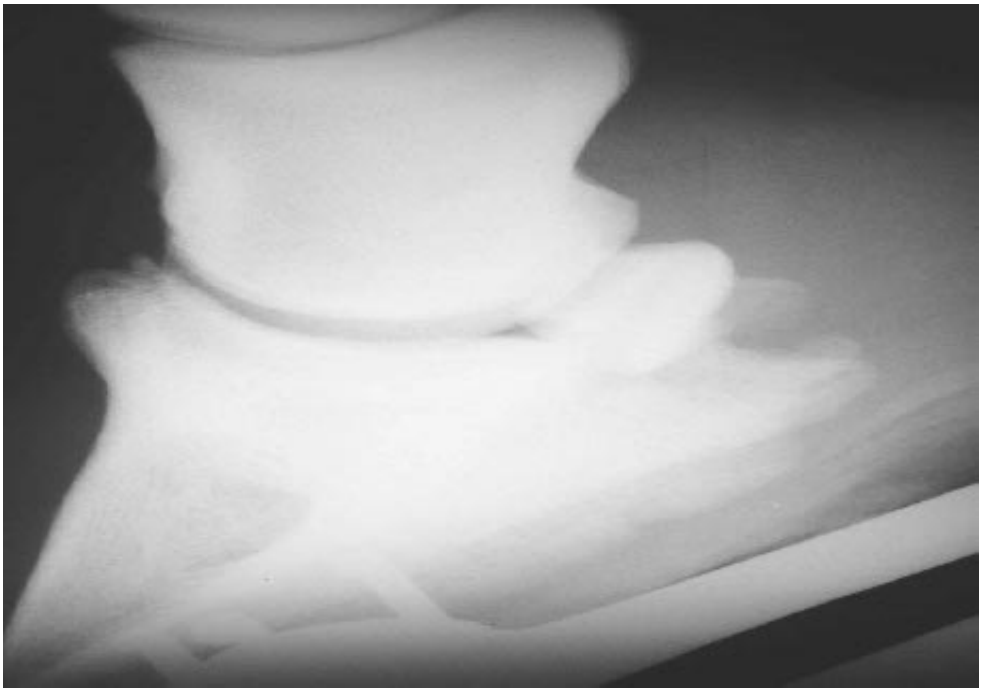

Fig. 3: Lateromedial radiograph showing a small radiopaque body proximal to the extensor process of the distal phalanx.

Fig. 4: Lateromedial radiograph showing a large diffuse (irregular) radiopaque body proximal to the extensor process of the distal phalanx.

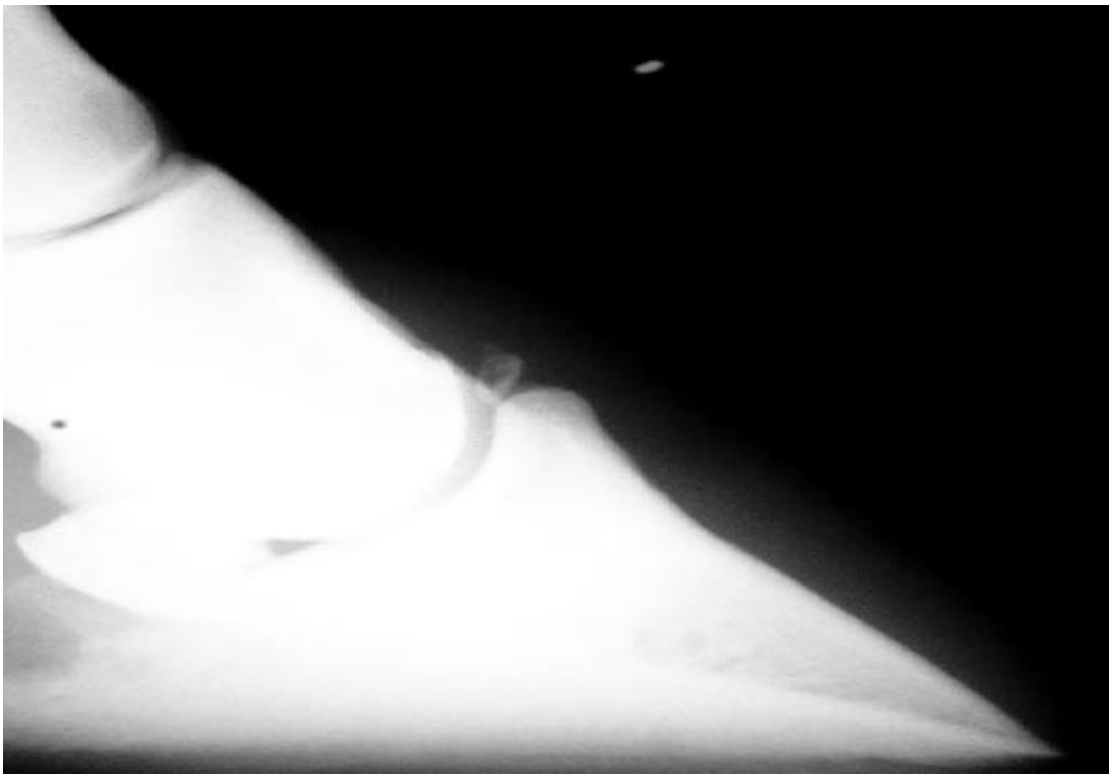

Fig. 5: Lateromedial radiograph showing a large oval (irregular) radiopaque body proximal to the extensor process of the distal phalanx.

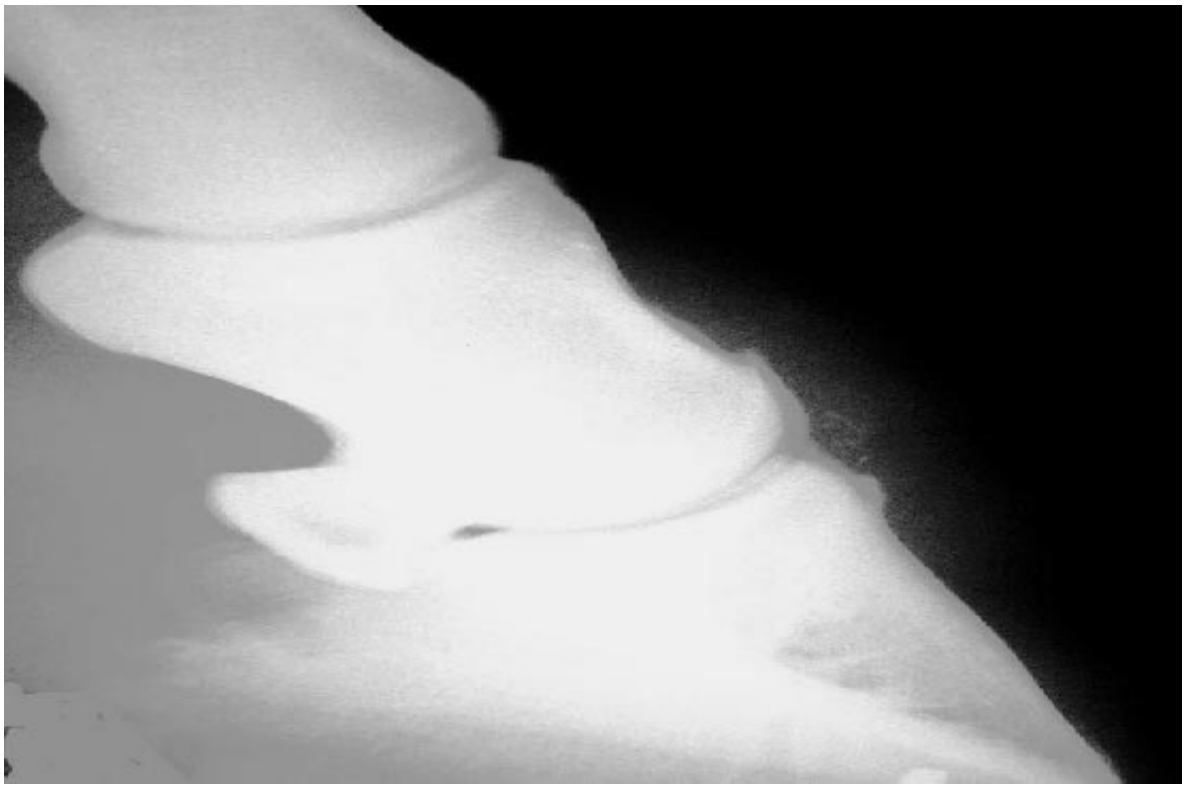

Fig. 6: Lateromedial postoperative radiograph showing a rest of very small radiopaque bodies proximal to the extensor process of the distal phalanx.

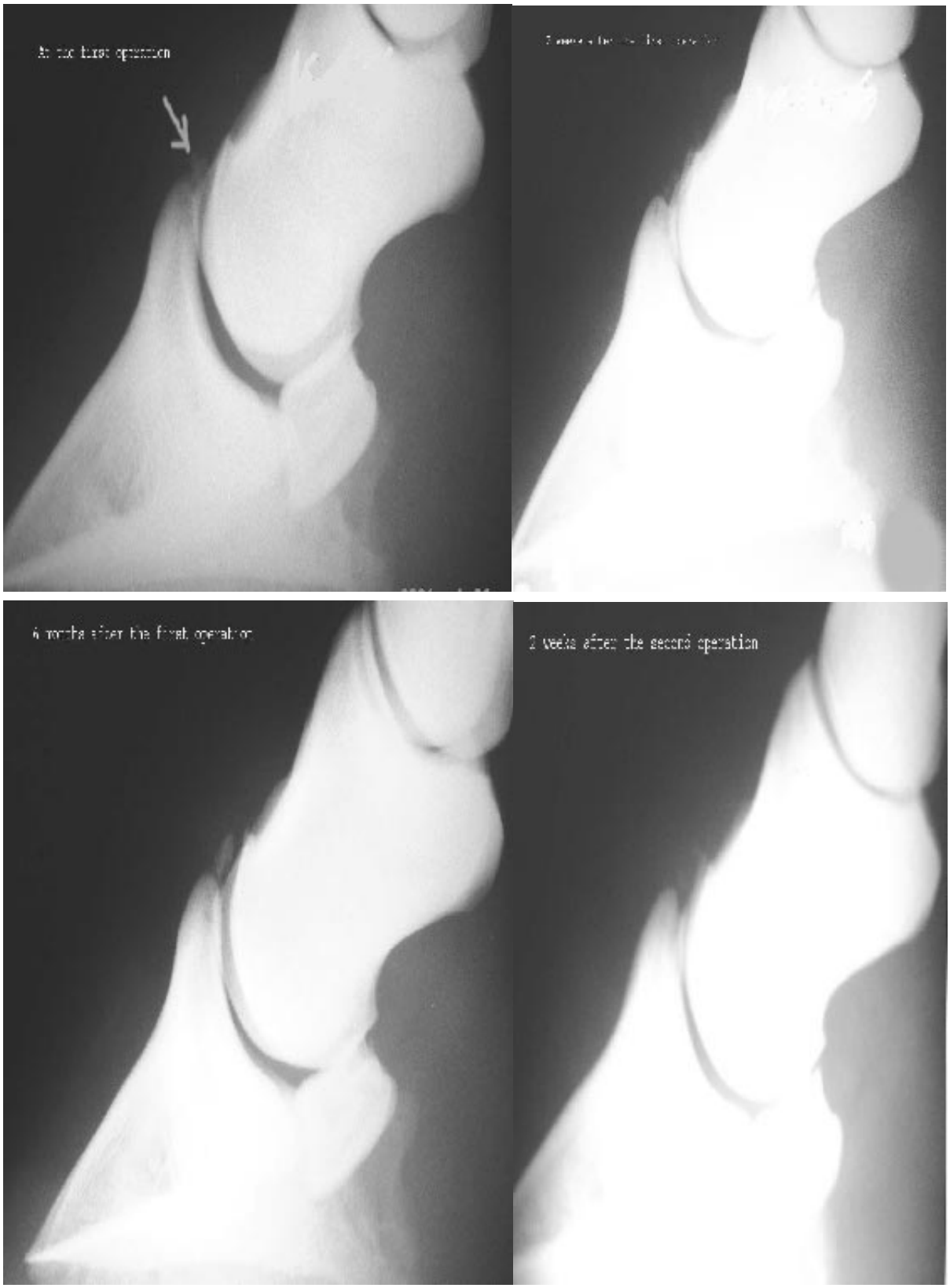

Fig. 7: Showing preoperative and postoperative radiographic follow up of the horse No. 24.

4.3. Fluoroscopy guided internal fixation of fractured extensor process of third phalanx (one horse).

A 3-year old Warm blooded gelding was presented with a 4-day history of right forelimb lameness. Examination revealed a painful, hard and firm swelling at the coronary band in the center of the hoof wall and a high degree of lameness. Lameness was temporarily alleviated by perinural analgesia of the palmar digital nerve at the base of the proximal sesamoid bone.
Radiographs showed a long standing fracture of the extensor process **(Fig. 8 left)**. The avulsed fragment was large and triangular in shape.
Under fluoroscopic guidance a 28 mm ASIF malleolar bone screw was inserted, but the fracture line could not be completely reduced.
A plaster cast was applied and left in place for 2 weeks after surgery. Following this the horse was given 8 weeks stall rest and then returned out in a paddock for 6 months.
Post operative radiographs revealed a slight proximal displacement of the fragment (no bony union at the fracture line); however healing was progressing normally **(Fig.8 right)**.
One year after surgery, the horse went back into their previous use and was sound.

Figure 8: Left, Large fracture of extensor process of distal phalanx. Right, ASIF screw in place.

4.4. Fluoroscopic guided extirpation of isolated shadows from the dorsal aspect of the proximal interphalangeal joint (3 horses).

There were 3 horses underwent fluoroscopic guided removal of isolated shadows from the proximal aspect of the proximal interphalangeal joint (table 7).

All horses were Warmbloods. The age was 5, 10 and 4 years respectively. Two of the 3 horses were female and one was sexually intact male. The affected limbs were; left forelimb, right hindlimb, and left hindlimb respectively.

Table 7.data on age, sex, breed and limb involved of the 3 cases.

Horse No.	Age (years)	Breed	Sex	Affected limb
1	5	Warm blooded	Female	Left forelimb
2	10	Warm blooded	Female	Right hindlimb
3	4	Warm blooded	Male	Left hindlimb

All the horses have a history of acute lameness. On admission to the clinic, mild firm swelling of the proximal interphalangeal joint was apparent on palpation in horse No. 1 and 2. All horses showed a mild degree of lameness. Lameness was exacerbated by flexion of the limb for 60 seconds. Intra-articular injection of the proximal interphalangeal joint with local anesthetic was performed in two horses (horse No.1 and 3) and resulted in temporarily elimination of the lameness. Radiography of the proximal interphalangeal joint revealed a large radiopaque body (more than 10 mm) at the dorsomedial aspect of the proximal portion of the 2nd phalanx in 2 horses (No.1 and 2) and a small radiopaque body at the dorsomedial aspect of the proximal portion of the 2nd phalanx in one horse **(Fig. 9)**.

Horse No. 3 had concurrently isolated shadow at the plantar aspect of the fetlock joint of the same limb and was removed under fluoroscopic control at the same time.

From the technical point of view all the operations were easily performed and no intraoperative complications were encountered.

Of the fragments removed, 2 were fixed firmly to P2 (horse No.1 and 2) and one (horse No. 3) was easily movable (but has soft tissue attachment to P2).

The actual exposure time of the fluoroscopy imaging C-arm device were recorded during 2 operations and were 3 and 4 minutes respectively.

During the period immediately after surgery, all horses did not have evidence of discomfort that exceed that detected before surgery (i.e., willing to bear weight on the affected leg and move easily around the stall). All horses have clean and dried incision line at the initial

bandage change and at all bandage changes; swelling was not detected within the joint or around the operative site. At 10 days after surgery all sutures were removed.

All horses were radiographed postoperatively and again within a period of 6 weeks post surgery. Radiographs did not reveal any productive bone changes (periosteal reactions) resulting from surgery. Postoperative radiograph revealed complete removal of the radiopaque body in all cases. All horses had successfully returned to their previous use at a level of performance equal to or greater than their performance.

Figure 9: Lateral radiographic view of the proximal interphalangeal joint of the left forelimb of horse No. 1.Showing a large radiopaque body at the dorsoproximal margin of the middle phalanx.

4.5. Fluoroscopic guided extirpation of isolated shadows from the dorsal aspect of the fetlock joint (46 horses).

There were 46 horses (38 Warmbloods, 5 Standardbreds, 2 Thorughbreds, and 1 Pony; 18 geldings, 16 females, and 12 intact males), with a mean age 5.4 year (range, 1-14 year), that underwent fluoroscopic guided surgery for removal of isolated shadows from the dorsal aspect of the metcapo/metatarsophalangeal joints.

Surgery was perfomed on a single metacarpophalangeal joint in 20 horses (11 right forelimbs and 9 left forelimbs), both metacarpophalangeal joints in 4 horses, a single metatarsophalangeal joint in 17 horses (11 right hindlimbs and 6 left hindlimbs), both metatarsophalangeal joints in 4 horses, and all four joints in one horse (Table 8).

Radiographic examination revealed that the radiopaque bodies originating from the dorsal proximal aspect of the first phalanx (46 joints), the dorsal proximal part of the sagittal ridge of the distal metacarpal or metatarsal bone (18 joints), and the dorsal aspect of the joint capsule as a synovial osteochondromatosis (3 joints) **(Fig. 10)**.

Of the 46 horses, 26 were admitted with a history of lameness, lameness examination was performed on 18 of them, the remainder being admitted for surgery only.

Lameness was scored on a 5-point scale (Annon 1991) and lameness grade ranged from mild to moderate degree (1 to 2 of scale 5). Lameness grade was mild for 20 horses and moderate for 6 horses. In 20 horses, the lesion was clinically silent and detected on prepurchase radiographic survey. Historically, the lameness was either acute in onset (18 horses) or chronic (8 horses). Synovial effusion ranged from mild to moderate degree was observed in 4 horses (No. 6, 20, 25, and 35). Fetlock-phalangeal flexion test was performed in 41 horses and was impossible in 4 horses (Table 9). 5 horses showed no lameness, 19 limbs showed mild positive results (mild degree of exacerbated lameness), 7 showed moderate positive results, 5 showed high positive results, and 1 showed doubtful positive result. Intra-articular analgesia of the metacarpophalangeal joint was performed in one horses (No. 10) and resolved or significantly improved the lameness degree, moreover perineural analgesia of the palmar/plantar metacarpal/metatarsal and palmar/plantar nerves was applied to 5 horses (No.8, 13, 29, 36, and 38) and resolved the lameness.

On radiography, additional fragments were also found on the distal intermediate ridge of the tibia in 3 horses (No.15, 17, and 29).

Three horses had treated concurrently with the aid of fluoroscopy for other lesions in the same limb. Two of them had radiopaque bodies in the region of the extensor process of the third phalanx and the third one had apical fracture of the proximal sesamoid bone.

A combination of fluoroscopy and arthroscopy techniques was used in 10 cases (Table 9). In 8 cases the isolated shadows were not detected by the arthroscopy technique but detected and removed under the fluoroscopic control and in 2 cases the isolated shadows could not be detected under fluoroscopic control but detected and removed through the arthroscopy technique. During the arthroscopic examination, 3 cases showed hypertrophy of the synovial villi, 1 showed hyperaemia of the synovial villi, 2 showed superficial fibrillation and erosion of the articular cartilage, and 4 cases showed no pathological changes. In the case No. 35, firstly the radiopaque body was lodged between the articular surfaces and could not be localized under fluoroscopic control firstly but later it was localized very easily after its displacement under arthroscopy control.

All the isolated shadows were completely removed but 2 partially removed since they were embedded and fixed firmly within the joint capsule. The fragments which removed were either floating free within the joints (22 cases), fixed firmly to the parent bone or the joint capsule (17 cases), or easily movable (but had soft tissue attachments) (8 cases). Their size approximately ranged from pepper seed to almond-size.

From the technical point of view all the operations were easily performed and no intraoperative complications were encountered. In some cases the radiopaque bodies were embedded within the joint capsule which makes retrieval difficult.

The actual screening time was recorded during 25 operations and the range was 1-6 minutes (mean time was 3 minutes).

During the period immediately after surgery, all horses did not have evidence of discomfort that exceed that detected before surgery (i.e., willing to bear weight on the affected leg and move easily around the stall). All horses have clean and dried incision line at the initial bandage change. Horses were typically discharged to their owner 10-14 days after surgery (after suture removal). Good cosmetic results, defined as lack of joint effusion or soft-tissue blemish were observed.

All horses were radiographed postoperatively and again within a period of 6 weeks post surgery. Radiographs did not reveal any productive bone changes (periosteal reactions) resulting from surgery. One case (No. 17) developed a second radiopaque body that was also removed under fluoroscopic control 2 months later. Finally all horses were sound for intended use following surgery.

Table 8: Age, breed, sex, affected limbs, origin of the affection and radiographic size of the cases subjected to fluoroscopic guided surgical removal of isolated shadows (radiopaque bodies) from the dorsal aspect of the fetlock joint.

Case No.	Age/ year	Breed*	Sex**	limb***	Origin of the affection	Radiographic size
1	9	WB	F	RH	Synovial osteochondrmatosis	Very large
2	5	WB	F	RH	Synovial osteochondrmatosis	Very large
3	4	WB	F	LH	Synovial osteochondrmatosis	Very large
4	4	SB	F	LH	Dorsal proximal part of the sagittal ridge of the distal MTII	Large
5	3	TB	M	RF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Small
6	3	WB	M	RH	Dorsal proximal part of the sagittal ridge of the distal MTII	Small
7	5	WB	F	RH	Dorsal proximal part of the sagittal ridge of the distal MCIII	Large
8	6	WB	G	LH	Dorsal proximal part of the sagittal ridge of the distal MTII	Small
9	6	WB	G	LH	Dorsal proximal part of the sagittal ridge of the distal MTII	Small
10	1.5	WB	M	L&R H	Dorsal proximal part of the sagittal ridge of the distal MTII	Small
11	4	WB	F	LF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Large
12	5	SB	F	RH	Dorsal proximal part of the sagittal ridge of the distal MTII	Large
13	9	WB	G	RF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Large
14	7	WB	G	LF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Very small
15	4	WB	F	L&R F	Dorsal proximal part of the sagittal ridge of the distal MCIII	Small
16	3	WB	G	RH	Dorsal proximal part of the sagittal ridge of the distal MTII	Very small
17	1	WB	M	LH	Dorsal proximal part of the sagittal ridge of the distal MTII	Very small
18	4	SB	G	RF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Very small
19	1	WB	F	RF	Dorsal proximal part of the sagittal ridge of the distal MCIII	Small
20	9	WB	G	L&R H	Dorsal proximal aspect of p1	Large
21	3	WB	M	All	Dorsal proximal aspect of p1	Large
22	1	SB	F	RH	Dorsal proximal aspect of p1	large
23	5	TB	M	RF	Dorsal proximal aspect of p1	Large
24	9	WB	G	LF	Dorsal proximal aspect of p1	Large
25	11	Pony	F	L&R F	Dorsal proximal aspect of p1	Very large
26	12	WB	G	L&R F	Dorsal proximal aspect of p1	Large
27	3	SB	M	LH	Dorsal proximal aspect of p1	Very large
28	5	WB	F	LF	Dorsal proximal aspect of p1	Large
29	13	WB	G	L&R H	Dorsal proximal aspect of p1	Large (R) Very small(L)
30	14	WB	F	RF	Dorsal proximal aspect of p1	Large
31	5	WB	G	RF	Dorsal proximal aspect of p1	Very large
32	7	WB	F	RF	Dorsal proximal aspect of p1	Small
33	2	WB	M	RH	Dorsal proximal aspect of p1	Large
34	2	WB	G	LF	Dorsal proximal aspect of p1	Small
35	2	WB	M	RH	Dorsal proximal aspect of p1	Small
36	7	WB	G	L&R F	Dorsal proximal aspect of p1	Large
37	7	WB	G	RF	Dorsal proximal aspect of p1	Large
38	3	TB	M	LF	Dorsal proximal aspect of p1	Small
39	2	WB	G	LF	Dorsal proximal aspect of p1	Small
40	8	WB	M	RF	Dorsal proximal aspect of p1	Very small
41	5	WB	G	RH	Dorsal proximal aspect of p1	Very large
42	6	WB	F	RF	Dorsal proximal aspect of p1	Small
43	4	WB	F	RF	Dorsal proximal aspect of p1	Very small
44	11	WB	G	RH	Dorsal proximal aspect of p1	Small
45	5	WB	G	LF	Dorsal proximal aspect of p1	Small
46	2	WB	M	L&R H	Dorsal proximal aspect of p1 (R) Dorsal proximal part of the sagittal ridge of the distal MTIII (L)	Small Large

*WB= Warm blooded; TB= Thoroughbred; SB= Standaedbred **G= Gelding; F= Female;M=Male***RF= Right front; LF= Left front; RH= Right hind; LH= Left hind

Table 9: Lameness character, lameness degree, the result of fetlock phalangeal flexion test and the result of fluoroscopy and arthroscopy technique.

Case NO.	Lameness character	Lameness degree	Joint flexion test	Fluoroscopy result	Arthroscopy result
1	Chronic	Mild	Impossible	Incompletely removed Multiple pieces Embedded and fixed Firmly within the joint capsule	Not detected Superficial erosion and fibrillation
2	Chronic	Moderate	++	Completely removed 2 pieces (pea and almond-size) Embedded and fixed firmly within the joint capsule	
3	Chronic	Moderate	++	Completely removed, Multiple pieces Embedded and fixed firmly within the joint capsule.	
4	chronic	Mild	+	Completely removed One piece (pea-size) Easily removed	
5	Acute	Mild	+++	Completely removed One piece (cherry seed-size) Floating within the proximal part of the sagittal ridge	Not detected No changes
6	No	No	-	Completely removed One piece (pea-size) Easily removed	Not detected Hypertrophy of Synovial villi Partial erosion of the articular cartilage
7	Chronic	Mild	+	Completely removed One piece (bean-size) Easily removed	
8	No	No	Impossible	Completely removed One piece (cherry seed-size) Floating within the joint	
9	Acute	Mild	+	Completely removed One piece (cherry seed-size) Floating within the joint	
10	Acute	Mild	++	Completely removed One piece (cherry seed-size) Floating within the joint	Not detected Hyperemia of the synovial villi
11	No	No	-	Completely removed One piece (bean-size) Easily removed	
12	No	No	-	Completely removed Multiple pieces Fixed firmly to the sagittal ridge	Not detected hypertrophy of the synovial villi
13	Chronic	Moderate	+	Completely removed One piece (pea-size) Floating within the joint	
14	No	No	+	Not localized	Detected Completely removed One piece (lentil-size) Floating within the joint
15	No	No	-	Completely removed One piece FR (Cherry seed-size) LH (bean-size) Floating within the joint	
16	No	No	+	Completely removed One piece (lentil-size) Floating within the joint	Not detected Hypertrophy of the Synovial villi
17	Acute	Mild	Impossible	First operation one piece (pepper seed-size) removed 2nd operation cherry seed-size removed Floating within the joint	

Table (9) (contd.)

18	No	No	-	Completely removed One piece (lentil-size) Floating within the joint	
19	No	No	Imposs -ible	Completely removed One piece (cherry seed-size) Floating within the joint	
20	No	No	-	Completely removed One piece (pea-size) Easily removed	
21	No	No	Imposs -ible	Completely removed One piece (pea-size) Easily removed	
22	No	No	+	Completely removed One piece (pea-size) Floating within the joint	
23	No	No	+	Completely removed 3 pieces (pea-size) Fixed firmly to P1	
24	Acute	Mild	+	Completely removed One piece (pea-size) Fixed firmly to p1	
25	acute	Mild	+++	Completely removed One piece (bean-size) Easily removed	
26	Acute	Mild	+	Completely removed One piece (bean-size) Embedded within the joint capsule	Not detected No lesions
27	No	No	-	Completely removed 2 pieces (pea and bean-size) Easily removed	
28	Acute	Mild	+	Completely removed One piece (pea-size) Floating within the joint	
29	Acute	Mild	++	Completely removed One piece (pea-size) RH One piece (pepper seed-size) Fixed firmly to P1	Not detected Hypertrophy of the synovial villi
30	Acute	Mild	+	Completely removed One piece (pea-size) Floating within the joint	
31	Acute	Mild	+	Completely removed 2 pieces (pea-size) Fixed firmly to P1	
32	Acute	Mild	+++	Completely removed One piece (cherry seed-size)) Floating within the joint	
33	No	No	+	Completely removed One piece (pea-size) Fixed firmly to P1	
34	Acute	Mild	+	Completely removed One piece (cherry seed-size)) Floating within the joint	
35	Acute	Moderate	+++	Not localized	Localized between the articular surfaces,Completely removed 2 pieces (lentil-size) Floating within the joint
36	Acute	Mild	+++	Completely removed One piece (pea-size) Fixed firmly to P1	
37	Acute	Mild	++	Completely removed One piece (pea-size) Fixed firmly to P1	
38	Chronic	Moderate	+	Completely removed One piece (cherry seed-size)) Floating within the joint	

Table (9) (contd.)

39	No	No	-	Completely removed One piece (cherry seed-size)) Floating within the joint	
40	No	No	+	Completely removed One piece (lentil-size) Floating within the joint	
41	Chronic	Moderate	+	Incompletely removed Multiple pieces Embedded within the joint capsule	
42	No	No	+-	Completely removed One piece (pea-size) Floating within the joint	
43	No	No	+	Completely removed One piece (lentil-size) Floating within the joint	
44	Acute	Mild	++	Completely removed One piece (pea-size) Fixed firmly to P1	
45	Acute	Mild	++	Completely removed One piece (pea-size) Fixed firmly to P1	
46	No	No	-	Completely removed one piece Lentil-size (RH), bean-size (LH) Floating within the joint (RH) Fixed firmly (LH)	

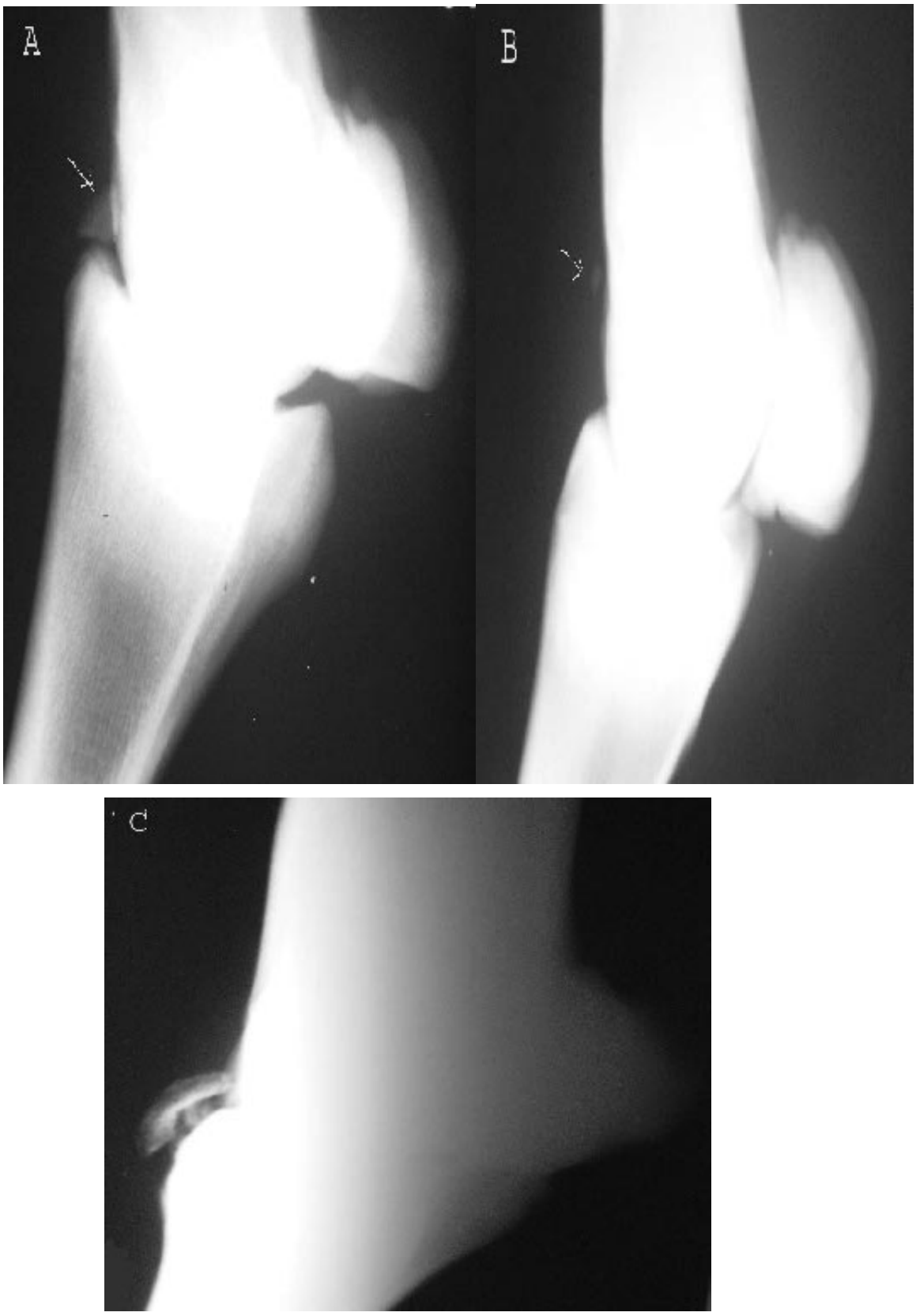

Figure 10: Lateral radiographs of the fetlock joint, revealing isolated shadows (A) on the dorsoproximal aspect of the proximal phalanx (B) on the dorsal proximal part of the sagittal ridge of cannon bone (C) on the dorsal joint capsule as a large osteochondromatosis

4.6. Fluoroscopic guided extirpation of isolated shadows from the palmar/plantar aspect of the fetlock joint (30 horses).

There were 30 horses, which were underwent fluoroscopic guided surgery for removal of radiopaque bodies from the plantar aspect of the fetlock joint. Warmblood horses constituted 60% (18) of the 30 horses; also included were 5 Thorughbreds, 4 Stanardbreds, 1 Arabian, 1 Polo Pony and 1 Quarter Horse. There were 12 females, 10 males, and 9 geldings (Table 10). This distribution was not significantly differed from that of the equine hospital population. The mean age was 6 years (range, 1 to 18 years).

27 operations performed on the hindlimbs with 15 on the left hindlimb and 12 on the right one, whereas 8 operations performed on the forelimbs with 5 on the left forelimb and 3 on the right one. Fife horses had bilateral surgery.

Radiographic examination and the result of surgery revealed that the radiopaque bodies originating from; the plantar eminence of p1 just medial to the sagittal groove (8 joints), medial wing of p1 (1 joint), osseous bodies or calcifications within the distal sesamoid ligament (13 joints of which 8 lateral and 5 medial), calcification within the lateral branch of the suspensory ligament (2 joints), calcification within the medial branch of the suspensory ligament (1 joint), and the apical part of the proximal sesamoid bone (10 joints of which 7 lateral and 3 medial) **(Figs 11-14)**.

Of the 30 horses, 24 were admitted with a history of lameness, lameness examination was performed on 16 of them, the remainder being admitted for surgery only.

Lameness was scored on a 5-point scale (Annon 1991) and lameness grade ranged from mild to high degree (1 to 3 of scale 5). Lameness grade was mild for 19 horses, moderate for 4 horses, and high for 1 horse. In 6 horses, the lesion was clinically silent and detected on prepurchase radiographic survey. Historically, the lameness was either acute in onset (14 horses) or chronic (10 horses). Synovial effusion of the metacarpophalangeal or metatarsophalangeal joint was reported in 3 horses (No. 10, 22, and 24). Fetlock-phalangeal flexion test was performed in 28 horses and was impossible in 2 horses (Table 11). 5 horses showed no lameness, 12 limbs showed mild positive results (mild degree of exacerbated lameness), 6 showed moderate positive results, and 6 showed high positive results. Intra-articular analgesia of the metacarpophalangeal joint was performed in 2 horses (No. 13 and 25) and resolved or significantly improved the degree of lameness, moreover perineural analgesia of the palmar/plantar metacarpal/metatarsal and palmar/plantar nerves was applied to 5 horses (No.2, 7, 12, 19, and 24) and resolved the lameness

On radiography, other fragments were found on the distal intermediate ridge of the tibia in 2 horses (NO.13 and 18). Four horses had concurrent lesions in the same limb, 3 of them concurrently operated with the aid of fluoroscopy (table 12)

Table 12: showing the horses that had concurrent lesions in the same limb and the method of their treatment.

Horse No.	Type of concurrent affection	Type of treatment
2	Isolated shadow at the dorsal aspect of the proximal interphalangeal joint.	Surgical removal at the same time under fluoroscopic guidance.
18	Sagittal fracture of the third phalanx.	Conservative managment
24	Isolated shadow in the region of the extensor process of the third phalanx.	Surgical extirpation under fluoroscopic guidance.
28	Isolated shadow at the dorsal aspect of the fetlock joint.	Surgical extirpation under fluoroscopic guidance.

A combination of fluoroscopy and arthroscopy techniques was used in 12 cases (table 11) in which arthroscopy was performed firstly and the isolated shadows could not be detected.

All the isolated shadows were localised with aid of fluoroscopy and completely removed but 2 were not removed and 1 partially removed since they were embedded and fixed within the distal sesamoid ligament. All the radiopaque bodies were not movable and fixed at the articular surface or within the ligaments and their size approximately ranged from cherry seed to almond-size. Arthroscopy showed hypertrophy of the synovial villi in 3 joints and the evidence of partial thickness fibrillation was noticed in 2 metarsophalangeal joints.

From the technical point of view all the operations were easily performed and no intraoperative complications were encountered. In some cases the radiopaque bodies were buried within the distal sesamoid or suspensory ligament which makes retrieval difficult.

The actual screening time was recorded during 20 operations and the range was 3-7 minutes (mean time was 4 minutes).

During the period immediately after surgery, all horses did not have evidence of discomfort that exceed that detected before surgery (i.e., willing to bear weight on the affected leg and move easily around the stall). All horses have clean and dried incision line at the initial bandage change. Only in one case (NO. 22) swelling was not detected within the joint or around the operative site which resolved after one week. Horses were typically discharged to their owner 10-14 days after surgery (after suture removal). Good cosmetic results, defined as lack of joint effusion or soft-tissue blemish were observed.

All horses were radiographed postoperatively and again within a period of 6 weeks post surgery. Radiographs did not reveal any productive bone changes (periosteal reactions) resulting from surgery. One case (No. 28) showed soft-tissue radiopacities in the joint surrounding region. After that all horses were sound for intended use following surgery.

Table 10: Age, breed, sex, affected limbs and origin of the affection of the cases subjected to fluoroscopic guided surgical removal of isolated shadows (radiopaque bodies) from the palmar/plantar aspect of the fetlock joint.

Case NO.	Age/year	Breed*	Sex**	Limbº	Origin of the affection
1	8	TB	G	LH	Plantar eminence of P1(medial)
2	4	WB	M	LH	Plantar eminence of P1(medial)
3	3	SB	F	RH	Plantar eminence of P1(medial)
4	5	WB	F	L&R H	Plantar eminence of P1(medial)
5	5	Arabian	M	RH	Plantar eminence of P1(medial)
6	7	TB	F	L&R H	Plantar eminence of P1(medial)
7	7	QH	M	LH	Plantar wing of P1 (medial)
8	12	WB	G	RH	Calcification within the distal sesamoid ligaments (lateral)
9	10	WB	M	R&L F	Calcification within the distal sesamoid ligaments (lateral; LF and medial; RF)
10	2	TB	M	LF	Calcification within the distal sesamoid ligaments (medial)
11	3	TB	F	LF	Calcification within the distal sesamoid ligaments (medial)
12	12	WB	G	RH	Calcification within the distal sesamoid ligaments (lateral)
13	1	WB	M	LF	Calcification within the distal sesamoid ligaments (medial)
14	17	WB	F	RF	Calcification within the distal sesamoid ligaments (lateral)
15	6	SB	M	LH	Calcification within the distal sesamoid ligaments (lateral)
16	3	SB	F	LH	Calcification within the distal sesamoid ligamenst (lateral)
17	3	WB	G	L&R H	Calcification within the distal sesamoid ligaments (lateral)
18	2	WB	M	LH	Calcification within the distal sesamoid ligaments (medial)
19	7	Polo Pony	F	LF	Calcification within the lateral branch of suspensory ligament.
20	11	WB	F	RH	Calcification within the lateral branch of suspensory ligament.
21	9	WB	G	RH	Calcification within the medial branch of suspensory ligament.
22	3	SB	M	LH	Apical part of the PSB (lateral)
23	5	WB	F	LH	Apical part of the PSB (lateral)
24	4	WB	G	RH	Apical part of the PSB (lateral)
25	16	WB	G	LH	Apical part of the PSB (medial)
26	2	TB	F	RF	Apical part of the PSB (medial)
27	18	WB	G	LH	Apical part of the PSB (medial)
28	2	WB	M	RH	Apical part of the PSB (lateral)
29	4	WB	F	R &L H	Apical part of the PSB (lateral)
30	3	WB	G	LH	Apical fracture of the PSB (lateral)

*WB= Warm blooded; TB= Thoroughbred; SB= Standardbred; QH= Quarter Horse

**G= Gelding; F= Female; M=Male

ºRF= Right front; LF= Left front; RH= Right hind; LH= Left hind

Table 11: Lameness character, lameness degree, the result of fetlock phalangeal flexion test and the result of fluoroscopy and arthroscopy technique.

Case NO.	Lameness character	Lameness degree	Joint flexion test	Fluoroscopy result	Arthroscopy result
1	Acute	Mild	+	Completely removed 3 pieces pea-size	Not detected Synovial villi hypertrophy
2	Acute	Mild	+	Completely removed One piece bean-size	
3	No	No	-	Completely removed One piece pea-size	
4	No	No	-	Completely removed one piece pea-size	
5	Chronic	Mild	+	Completely removed One piece pea-size	Not detected Synovial villi hypertrophy
6	No	No	-	Completely removed Multiple pieces	
7	Acute	Moderate	++	Completely removed 2 pieces pea and almond-size	
8	No	No	-	Completely removed One piece bean-size	Not detected No lesions
9	Acute	Mild	++	Completely removed Multiple pieces	
10	Acute	Mild	Impossible	Incompletely removed Part was fixed within the ligament	Not detected No changes
11	Chronic	Mild	+	Completely removed One piece pea-size	Not detected No changes
12	Chronic	Mild	+	Completely removed One piece bean-size	
13	Acute	Mild	+	Completely removed Multiple pieces	Not detected No changes
14	Chronic	Mild	+	Completely removed 3 pieces pea-size	Not detected No changes
15	No	No	+	Localised but not removed	Not detected No changes
16	No	No	-	Incompletely removed Part was embedded	Not detected No changes
17	Acute	Mild	RH ++ LH +	Completely removed One piece pea-size	Not detected Partial-thickness Cartilage fibrillation
18	Acute	Mild	+	Localised but not removed	Not detected No changes
19	Chronic	Mild	+++	Completely removed Multiple pieces	
20	Acute	Mild	++	Completely removed Multiple pieces	Not detected Synovial villi Hypertrophy
21	Chronic	Mild	+	Completely removed Multiple pieces	
22	Acute	High	++	Completely removed 2 pieces pea-size	
23	Acute	Mild	+++	Completely removed One piece bean-size	
24	Acute	Mild	+++	Completely removed One piece almond-size	
25	Acute	Moderate	+++	Completely removed One piece almond-size	
26	Acute	Moderate	+++	Completely removed One piece bean-size	
27	Acute	Mild	+	Completely removed One piece cherry seed-size	
28	Acute	Moderate	+++	Completely removed One piece almond-size	
29	chronic	Mild	Impossible	Completely removed One piece cherry seed-size	

Figure 11: Lateral radiograph showing isolated shadow (arrow) originating from the proximal plantar aspect of the proximal phalanx.

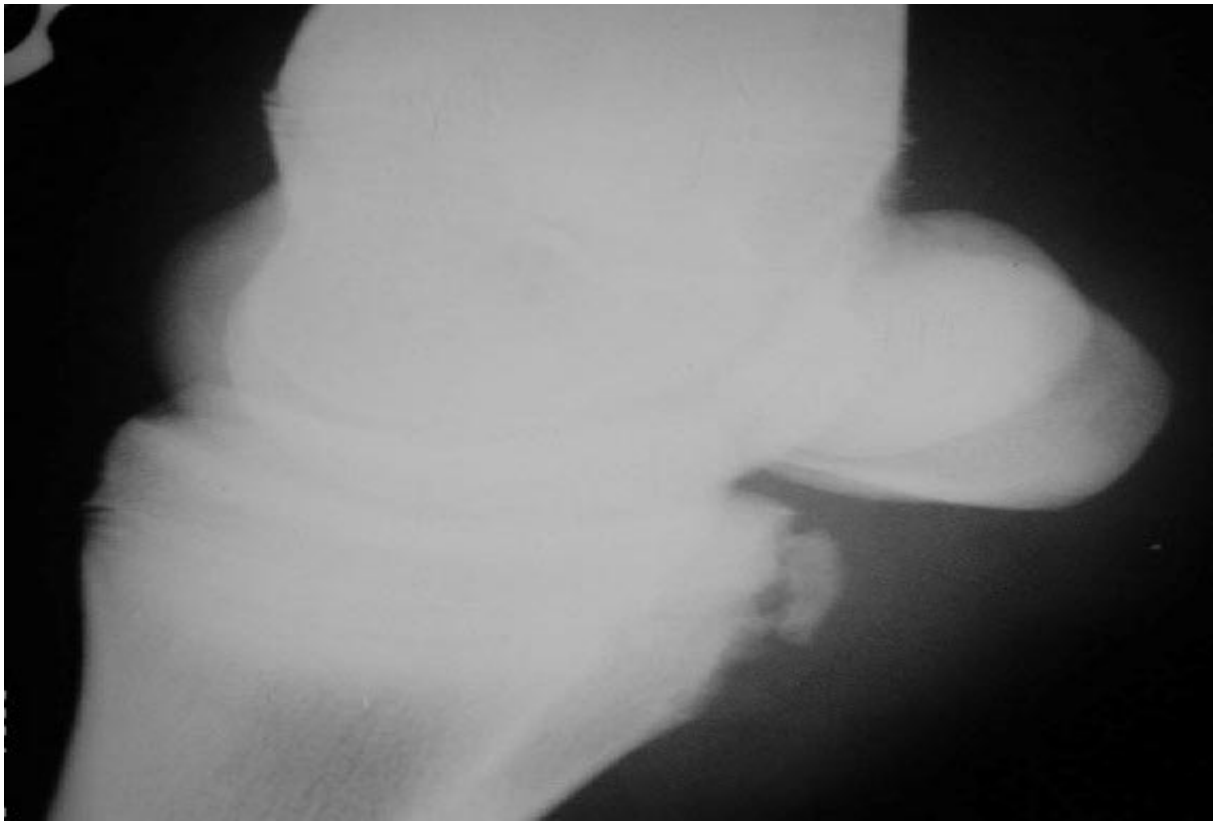

Figure 12: Lateral radiograph showing isolated shadow originating from the plantar eminence of the proximal phalanx

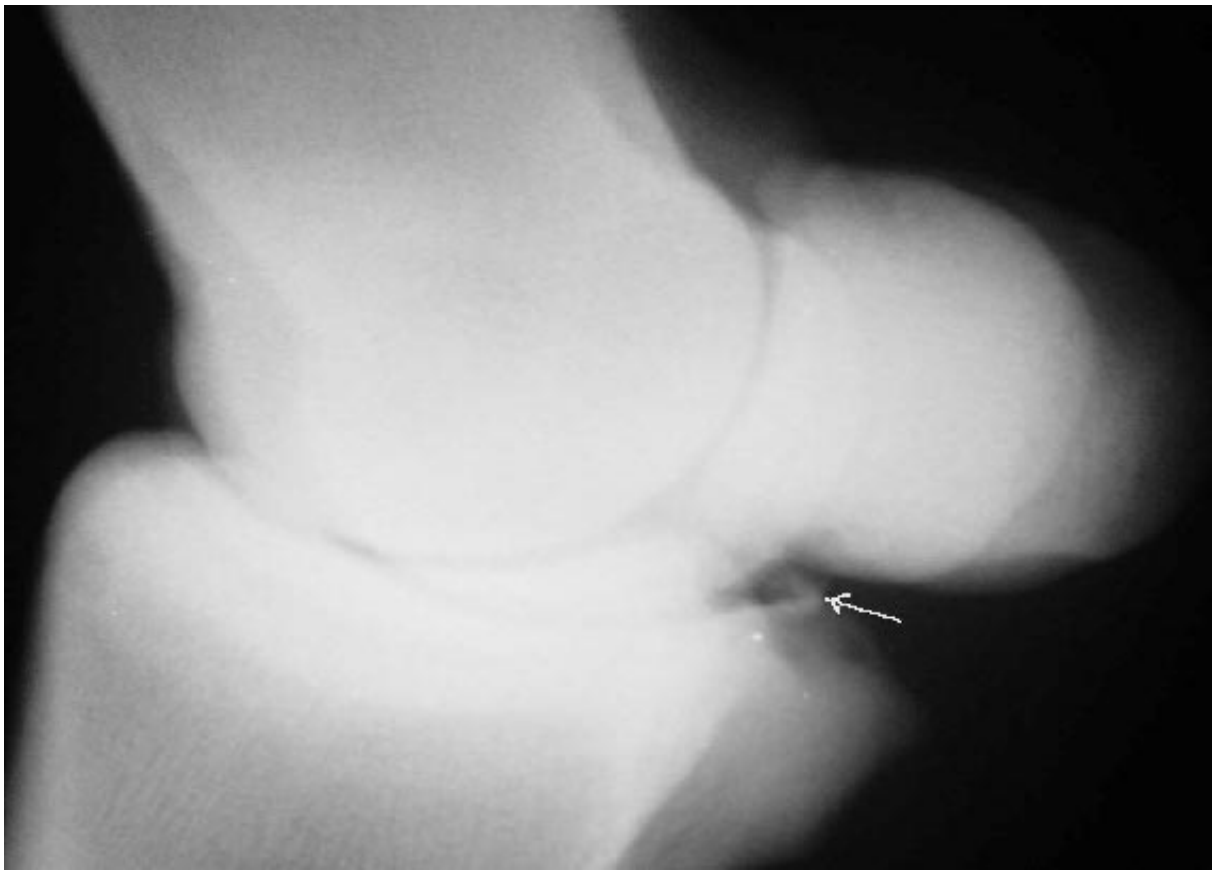

Figure 13: Lateral radiograph showing isolated shadow (arrow) within the distal sesamoid ligaments.

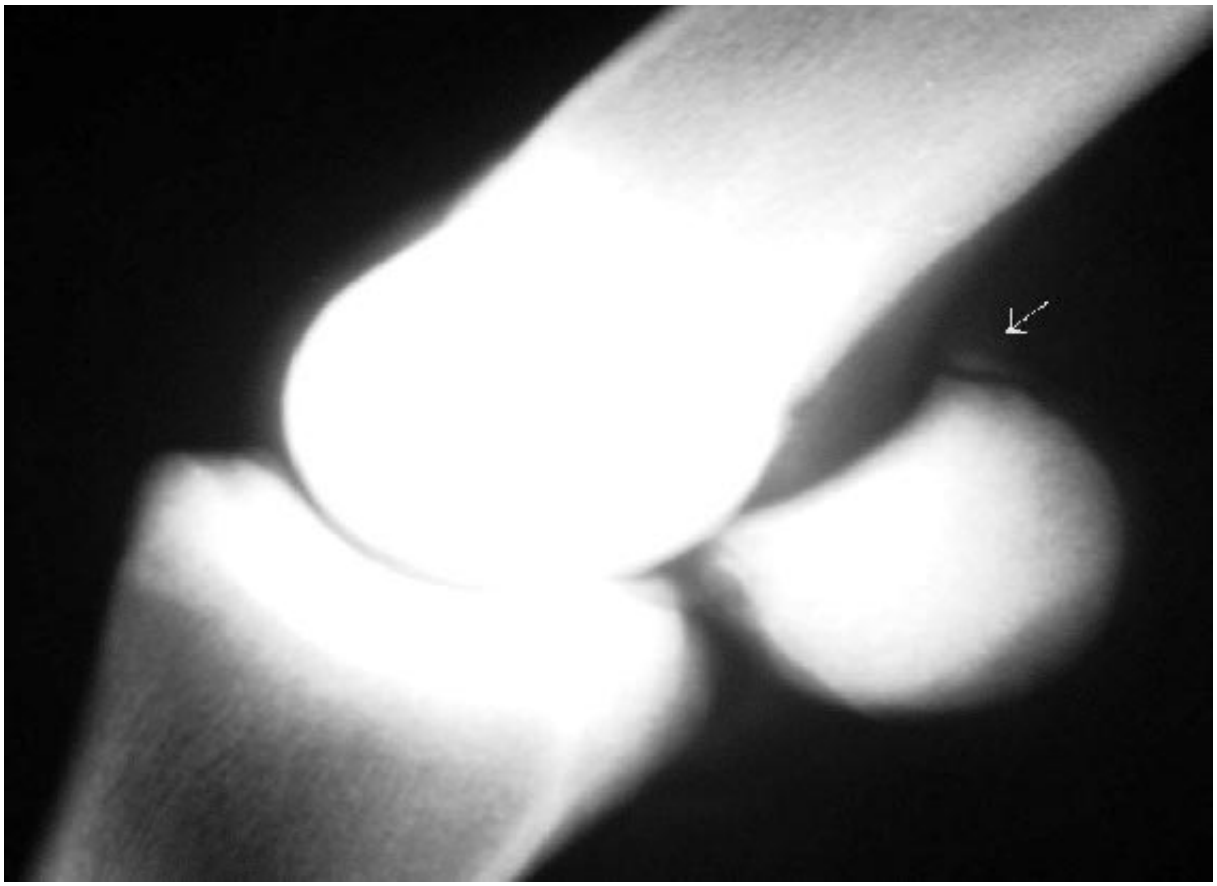

Figure 14: Lateromedial radiographic projection demonstrating an apical proximal sesamoid bone fracture.

4.7. Fluoroscopic guided internal fixation of proximal sesamoid bone transverse basilar fracture (one horse).

A 6-year old Warm blooded Female was presented with a history of acute and high degree lameness of the right forelimb. Examination revealed a painful swelling in the region of the fetlock joint. The horse was reluctant to bear weight on the limb and would not permit the fetlock to descend to a normal position. Radiographs showed a displaced transverse articular fracture of the base of the medial sesamoid bone **(Fig. 15 left)** and an additional sagittal fracture of the third phalanx. Under fluoroscopic guidance 4.5-mm ASIF cortical bone screw was inserted in a lag fashion from the base of the sesamoid bone. The fracture was completely reduced and the sagittal fracture of the third phalanx was conservatively managed. A plaster cast was applied and left in place for 3 weeks after surgery. Following this the horse was given 8 weeks stall rest and then returned out in a paddock for 8 months. Post operative radiographs revealed that the healing was progressing normally and no degenerative joint changes were observed **(Fig. 15 right)**. One year after surgery, the horse went back into their previous use and was sound.

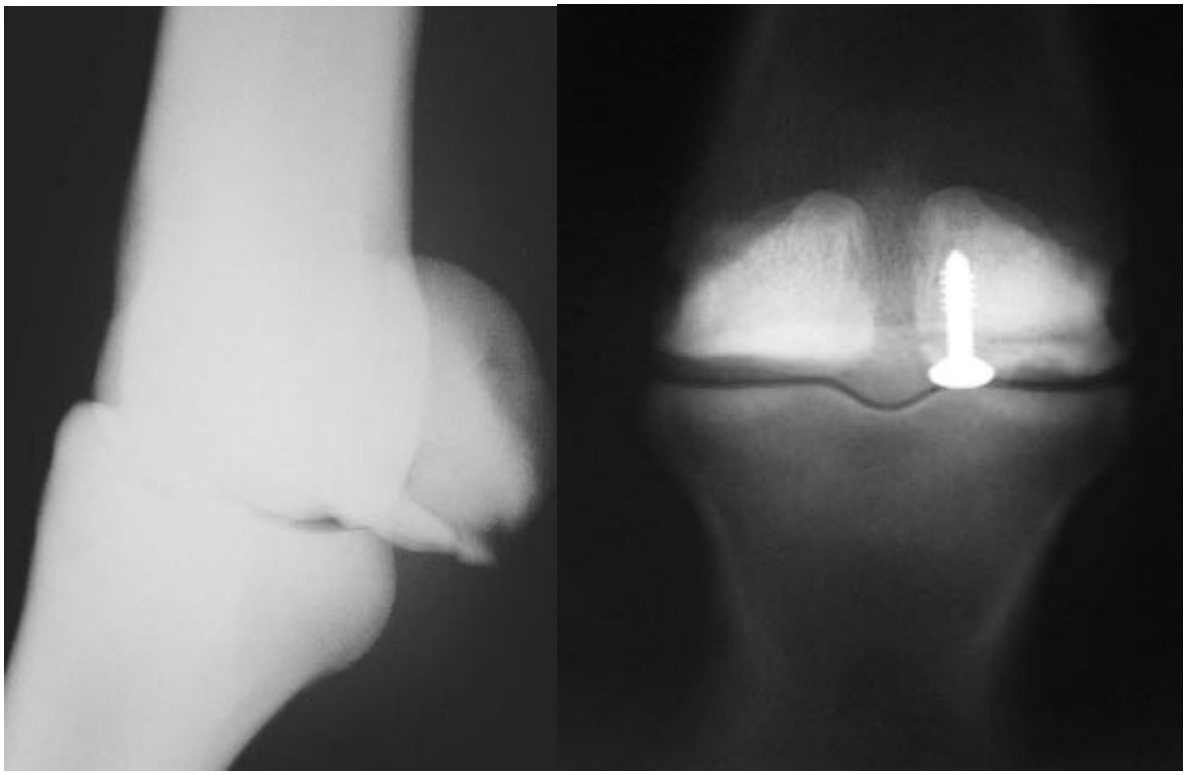

Figure 15: Transverse articular fracture of the base of the medial proximal sesamoid bone (left) and the same fracture 3 months postoperatively (right).

4.8. Fluoroscopic guided lag- screw internal fixation of condylar fractures of MC-3 or MT-3 (4 horses).

There were 4 Thoroughbred horses with condylar fractures of MC3 and MT-3 which underwent fluoroscopic guided lag- screw internal fixation. All the horses were 3 years old and sexually intact males. The fracture types were: complete nondisplaced (horse No. 1), complete displaced (horse No. 2 &3), and spiral or longitudinal diaphyseal (horse No. 4) **(Fig. 16)**. The right forelimb was affected in the horses No.1 &2 while the right hindlimb was affected in the horse No. 3 &4. The fracture involved the lateral condyle in the horses No 1, 2, & 3 and the medial condyle in the horse No. 4.

All the horses presented with an established diagnosis by a referring veterinarians with a history of high degree lameness after racing.

Application of lag-screw principles was successful in achieving compression across the fracture in all cases. The number of cortical screws most commonly used was 2 cortical screws. The location of the distal-most screw was either in the fossa, between the fossa and the tubercle, or at the tubercle.

From the technical point of view the application of the lag-screw principles was easy and no intraoperative complications were encountered.

Only one horse postoperatively was unable to bear weight on the affected limb and has administrated non steroidal anti-inflammatory drug. Follow up (2-4 month) radiographic examination **(Fig. 17)** revealed excellent healing without any disturbances and all the horses returned to racing.

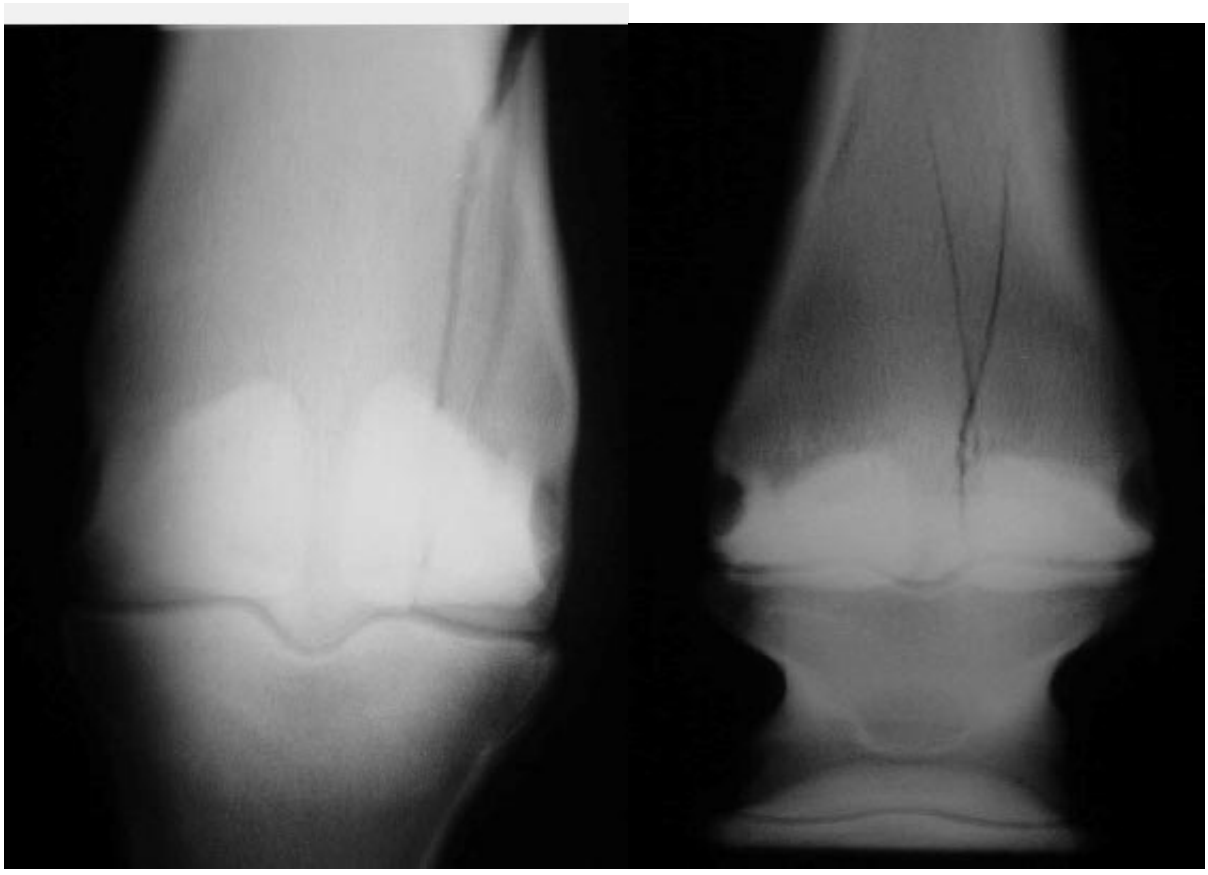

Figure 16: Left, A complete displaced condylar fracture. Right, longitudinal or diaphyseal fracture involving the medial condyle of The MT-3.

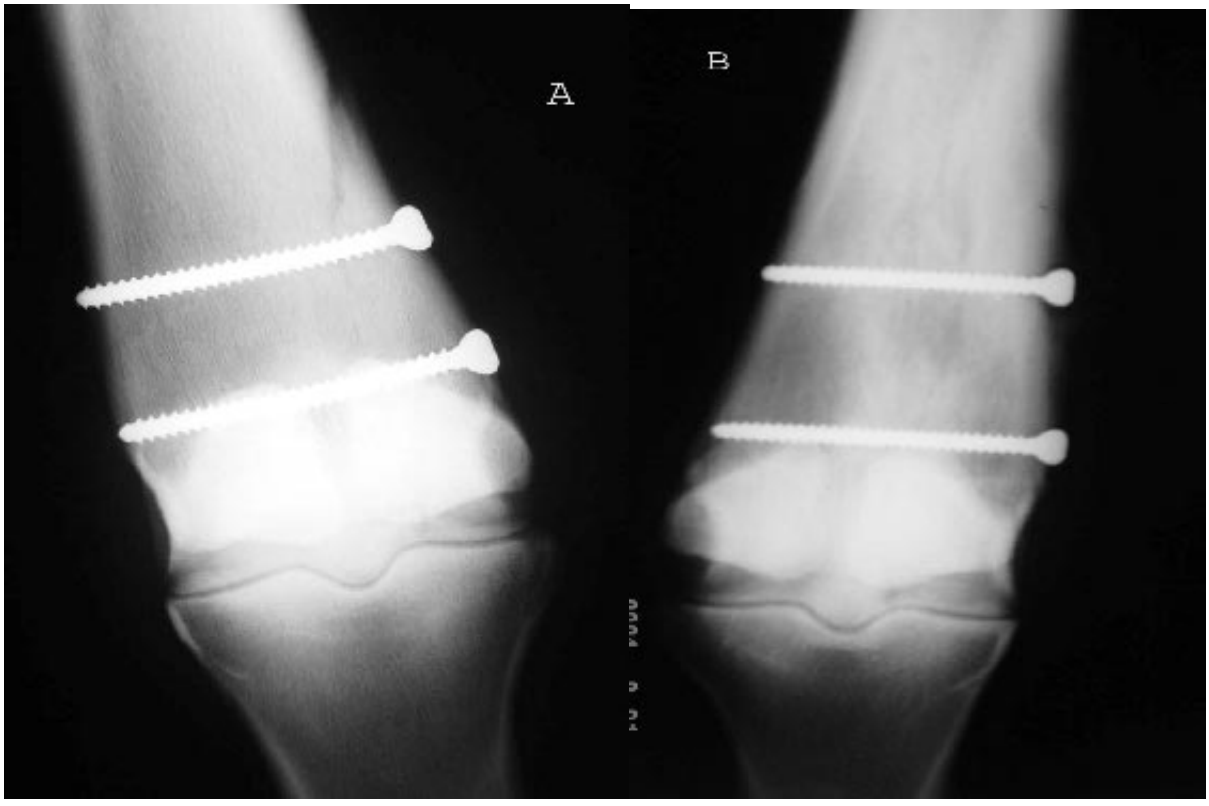

Figure 17: Follow up radiographic view 2 months postoperatively showing excellent healing of the above condylar fractures. (A, complete displaced condylar fracture and B, longitudinal or diaphyseal fracture)

4.9. Fluoroscopic guided lag- screw internal fixation of noncomminuted articular fractures of the proximal phalanx (19 horses).

There were 19 horses with noncomminuted articular fractures of P1 which underwent fluoroscopic guided lag-screw internal fixation (Table 13). 11 were Warmbloods, 5 Standardbreds, and 3 Thoroughbreds. Mean age was 5 years (range, 2 to 14 years). There were 11 females, 5 geldings, and 3 sexually intact males. The number of forelimb fractures (12) was significantly greater than the number of hindlimb fractures (7). Number of right hind limb (3) and left hindlimb (4) fractures were not significantly differ, but there were significantly more right forelimb (8) than right hindlimb fractures.

The fracture types were:

- Short incomplete (less than 30 mm long) mid sagittal ……...(6 horses)
- Long incomplete mid-sagittal……..(4 horses)
- Long complete mid-sagittal…….(5 horses)
- Complete dorsal frontal with displacement…….(1 horse)
- Complete dorsal frontal without displacement……(1 horse)
- Distal articular fracture……(1 horse)
- Lateral Plantar eminence fracture ……...(1 horse)

Most horses presented with an established diagnosis by a referring veterinarians or fracture was diagnosed in our clinic. All horses except horse No.19, on arrival showed a high degree of lameness (3 to 4 on a scale of 0 to 5) and were reluctant to bear weight on the affected limb. Most horses had increased digital pulse and synovial effusion of the affected joint, signs of pain on palpation of P1 and lameness that worsened after distal limb flexion tests. Horse No.19 showed a mild degree of acute lameness which was exacerbated after forced flexion of the fetlock joint.

Application of lag-screw principles was successful in achieving an optimal compression across the fracture in all cases. Accurate anatomic realignment of the articlar surfaces and rigid internal fixation by interfragmently compression after application of the lag-screws was obtained. The number of cortical screws most commonly used was 1 to 3 cortical screws according to the size of the fracture line. Joint puncture at the end of the operation showed haemarthrosis in 2 cases (No.13 &17), which received additional joint flushing with sterile Ringer's solution.

From the technical point of view the application of the lag-screw principles was easy, fast and no intraoperative complications were encountered. Only two horses postoperatively (No. 5&13) were unable to bear weight on the affected limb for 2-3 days and had administrated nonsteroidal anti-inflammatory drug.

Follow up radiographs taken 8 weeks later showed excellent primary bone union with no joint deformity **(Fig. 18)**. Radiographic examination at 4 months following surgery revealed a good bony healing of the fracture with no evidence of periosteal proliferation or DJD. Case No. 9 showed a periosteal proliferation at the medial aspect of P1 but without any interference with the joint function. Case NO. 5 showed a new periosteal proliferation around the proximal interphalangeal joint (periarticular ring bone) and no improvement in the lameness was observed, for this reason a high neurectomy was performed in this limb to avoid the occurrence of laminitis in the controlateral limb. After that all the horses survived to go home.

Table 13: Age, breed, sex, affected limbs and fracture type of the cases subjected to Fluoroscopic guided lag- screw internal fixation of noncomminuted articular fractures of the proximal phalanx

Case No.	Age/year	Breed*	Sex**	Limb***	Fracture type
1	2	TB	F	RF	Long incomplete mid-sagittal
2	4	TB	G	RF	Short incomplete mid-sagittal
3	6	WB	G	LF	Short incomplete mid-sagittal
4	7	WB	F	RF	Dorsal frontal (complete with displacement)
5	8	WB	F	RH	Distal articular
6	5	WB	G	RF	Short incomplete mid sagittal
7	8	WB	F	LF	Long complete mid-sagittal
8	3	TB	F	RF	Long incomplete mid -sagittal
9	2	WB	M	RF	Short incomplete mid -sagittal
10	2	SB	F	LH	Short incomplete mid -sagittal
11	3	WB	F	LH	Complete dorsal frontal without displacement
12	4	SB	M	RH	Long complete mid-sagittal
13	8	WB	G	RH	Long complete mid-sagittal
14	7	WB	F	LF	Long complete mid-sagittal
15	4	SB	F	RF	Long incomplete mid-sagittal
16	3	SB	F	LH	Long complete mid-sagittal
17	2	SB	M	LF	Long incomplete mid-sagittal
18	14	WB	G	RF	Short incomplete mid-sagittal
19	9	WB	G	LH	Proximal lateral plantar eminence of P1

*WB= Warm blooded; TB= Thoroughbred; SB= Standardbred; QH= Quarter Horse

**G= Gelding; F= Female; M=Male

***RF= Right front; LF= Left front; RH= Right hind; LH= Left hind

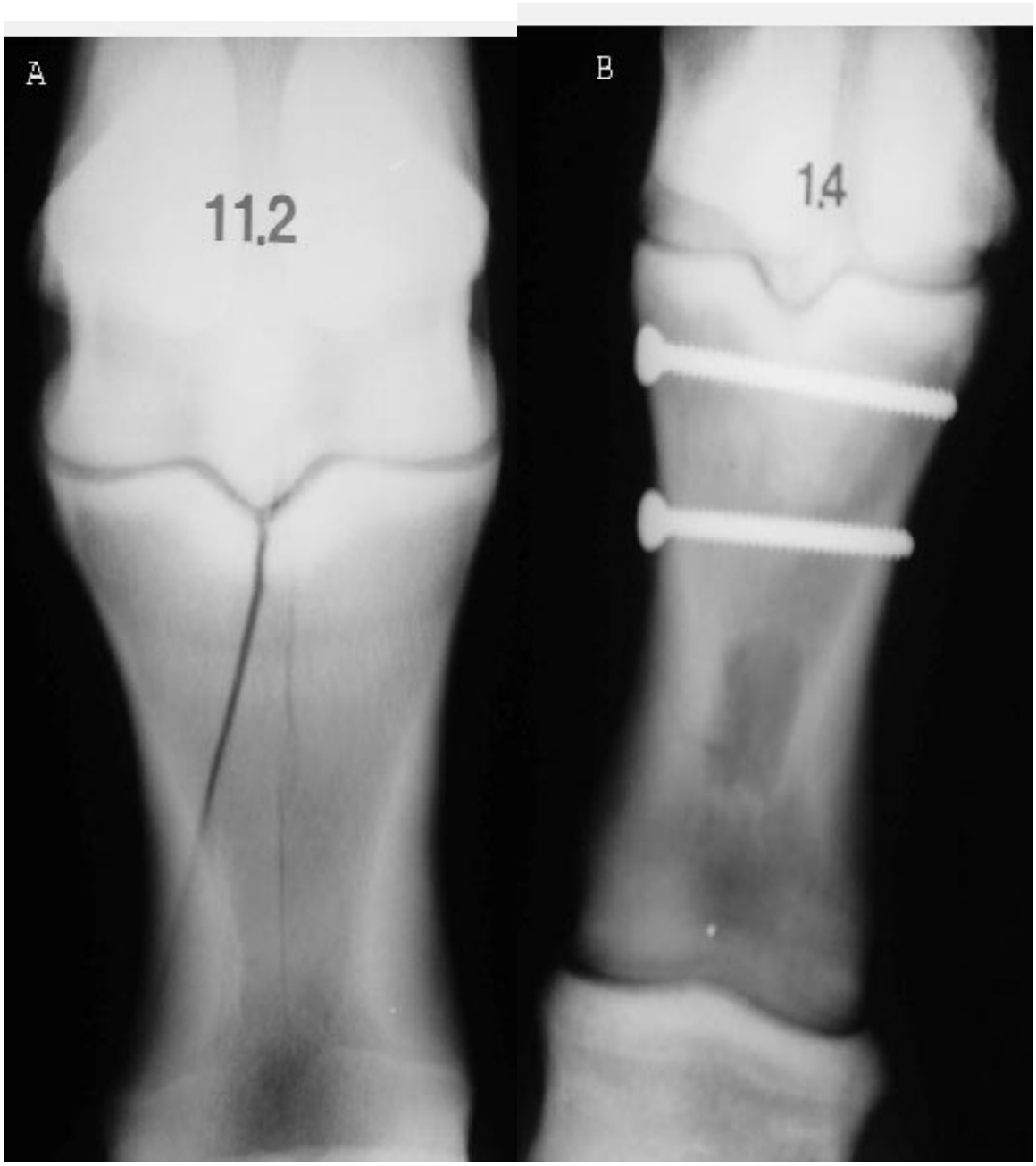

Figure 18: Long incomplete fracture of the proximal phalanx (A) that was repaired with lag screw (B).

4.10. Fluoroscopic guided surgical management of subchondral cystic lesions (SCLs) within the phalangeal joints (8 horses).

There were 8 horses in the study population (table 14) which received fluoroscopic guided transcutaneous extra-articular drilling and packing of the SCSLs with autogenous cancellous bone graft. The breed distribution included 6 Warmbloods (WB) and 2 Standardbreds (SB). There were 2 sexually intact males, 3 females, and 3 geldings in the population. The median age was 6 years (range, 2-12 years) at the time of surgery. Cystic lesions were confined to; the medial condyle of MCIII in 2 horses (left forelimb), distal aspect of P2 in 3 horses (right fore-limb and left forelimb), proximal aspect of P2 in 1 horse (left hindlimb), distal condyle of the P1 in 1 horse (right hindlimb), and the lateral proximal sesamoid bone in 1 horse (left fore-limb).

Fife of the 8 horses exhibited a mild degree of lameness (grade 1 of 5: Annon 1991) and 3 horses showed a moderate degree (grade 2 or 3 of 5). Historically, the lameness was either acute in onset (3 horses) or observed intermittently (5 horses). A mild synovial effusion of the metacarpophalangeal joint was observed in one case (No. 2), while a moderate degree of effusion of the dorsal and plantar aspect of the distal interphalangeal joint was observed in one case also (No. 4). Forced flexion of the affected joints significantly exacerbated the lameness in all clinically affected horses. Joint flexion test was impossible to perform in one case (No. 3) due to excitable temperament. Intra-articular analgesia of the proximal interphalangeal joint was performed in two cases (horse No. 1&4) and resolved or significantly improved the degree of lameness. Perineural analgesia of the palmar/plantar metacarpal/metatarsal and palmar/plantar nerves resolved the lameness in 6 horses in which intra -articular analgesia was not performed.

Case No.4 was operated concurrently for removal of isolated shadow from the region of the extensor process of the third phalanx.

SCLs were consistently identifiable on the dorsopalmar view and frequently visible on the standing and /or flexed lateromedial views **(Fig.19)** The cystic lesions diameter ranged from 15-20mm. Additional Computer Tomography was performed in case No. 8 to confirm the diagnosis of SCL in the lateral proximal sesamoid bone **(Fig.20)**.

Radiographically, the osseous borders of the cystic lesions were clearly definable in most cases and a peripheral zone of sclerosis was usually present. The cystic cavity appeared lucent and contained focal mottled opacities. The lesion exhibited a diffuse communication with the articular surface in all cases except case No. 1 &8.

The surgical approach was simple and easy from the technical point of view and adequate amount of autogenous cancellous bone to fill the drilled out cyst was obtained in all cases.

During the period immediately after surgery, all horses did not have evidence of discomfort that exceed that detected before surgery (i.e., willing to bear weight on the affected leg and move easily around the stall). All horses have clean and dried incision line at the initial bandage change and at all bandage changes; swelling was not detected within the joint or around the operative site. Also a peri-incisional edema was not present over the tuber coxae and the incisions were healed without complications **(Fig. 21)**. All horses were discharged following suture removal.

Radiographs obtained 4weeks post operatively revealed increase in opacity and partial resolution of the cyst (evidence of osseous healing) although its outline was still clearly visible. No evidence of degenerative joint disease was present. Eight months post-operatively, no evidence of the presence of cyst was observed in horse No. 3 and 5 and increased radiodenisty but not completely obliterated was observed in horse No. 6 and 7. No follow up x-ray obtained for the other cases.

The treatment was successful and 6 horses were sound for intended use following surgical treatment. Follow up information was unavailable for one horse (No. 1) and too recent in another horse (No. 7).

Table 14: details of the 8 cases treated by autogenous bone graft.

Case No.	Age	Sex*	Breed**	limb***	Position of the SCLs	Lameness degree	Lameness character
1	12 Y	M	WB	RF	Distal aspect of P2	Mild	Chronic
2	8 Y	F	WB	LF	Medial condyle of MC III	Moderate	Acute
3	2 Y	G	SB	RH	Distal condyle of P1	Mild	Chronic
4	10 Y	F	WB	RF	Distal aspect of P2	Mild	Chronic
5	4 Y	M	WB	LF	Distal aspect of P2	Moderate	Acute
6	3 Y	M	SB	LH	Proximal aspect of P2	Mild	Chronic
7	2 Y	F	WB	LF	Medial condyle of MC III	Mild	Acute
8	6 Y	G	WB	LF	Lateral proximal sesamoid bone	Moderate	Chronic

*WB= Warm blooded; SB= Standaedbred; QH= Quarter Horse

**G= Gelding; F= Female; M=Male

***RF= Right front; LF= Left front; RH= Right hind; LH= Left hind

Fig. 19: A dorsal plantar radiographs showing subchondral lucencies and sclerosis in the proximal extremity of the middle phalanx.

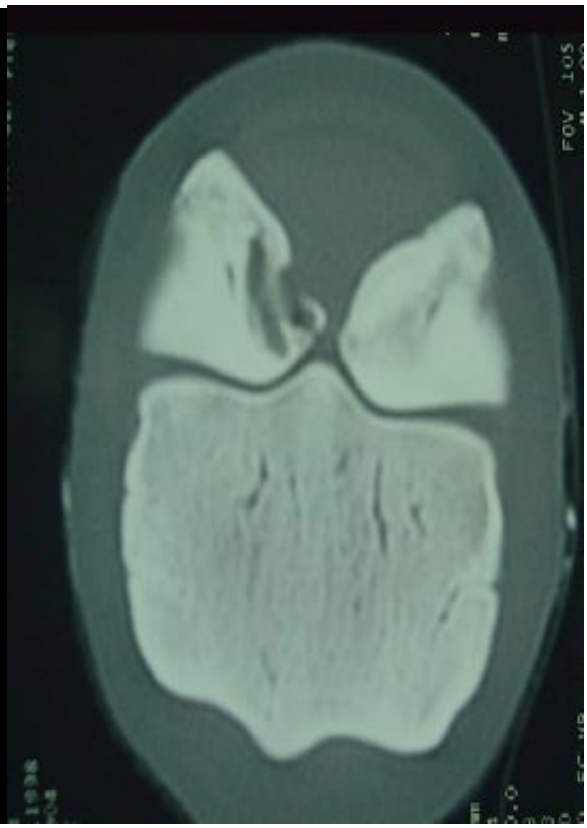

Fig. 20: Computer Tomographic appearance of a cyst-like defect in the lateral proximal sesamoid bone

Figure 21: Appearance of the donor site 10 days after Surgery