positioned in lateral recumbency with the affected limb above the table. A 1.5 inch 18G needle was inserted in the caudo dorsal portion of the joint between the anconeal process and the olecranon fossa. Synovial fluid was aspirated and the joint subsequently distended with 10 to 15 ml of lactated ringer's solution. The arthroscopic portal for medial approach was then made along the arc of the trochlear notch approximately 1 cm distal to the prominence of the epicondyle. A stab incision was made at this point with a No. 11 Bard Parker blade and the sleeve with sharp trocar was inserted through the incision. Following entry into the joint the trocar was removed and the telescope was coupled with the cannula.For visual exploration of the hip joint, an egress portal and an arthroscope portal was used. For the right hip, the arthroscope portal was placed at 12 o'clock and the egress portal at 5 o'clock. For the left hip, the arthroscope and egress portals were placed at 12 o'clock, and 7 o'clock, respectively. Optimal portal placement was verified intraarticularly by visualization of a guide needle. An 18 to 22-gauge spinal needle (2.5- to 3-inch) was used as a guide to confirm the position for this portal. The hip was flexed slightly, and the femur was positioned parallel to the table to maximize the width of the joint space. The hip was palpated, and the needle was inserted at the midpoint of the proximal edge of the greater trochanter. For stifle joint, the patient was positioned in dorsal recumbency with the pelvis placed at the end of the operating table to facilitate unobstructed access to both sides of the stifle. A cranio-medial approach was chosen. An 18 G hypodermic needle was inserted into the supra patellar pouch and synovial fluid was withdrawn. The joint was then distended with 10-20 ml of lactated ringer's solution. A stab incision was made lateral to the patellar tendon mid -way between the distal aspect of the patella and the tibial crest. The egress cannula with the sharp trocar was directed from cranio-laterally to cranio-medially into the joint. As soon as the joint capsule was penetrated, the sharp trocar was replaced with the blunt obturator. The joint was extended and the blunt trocar was directed parallel to the trochlear groove into the femoro-patellar joint. The trocar was then replaced with the arthroscope. The egress needle was inserted into the proximal patellar joint space parallel to the patella.Irrigation of the joint with sterile lactated ringer's solution was used for joint distension and flushing of debris from the joint space thereby providing clear visualization of the structures of the joint cavity.

5. Results and Discussion

Arthroscopic examination of the 6 cases of elbow affected dogs examined revealed two cases of osteochondritis dissecans i.e., in case 1d and 1f (Fig 2), one case of fragmented medial coronoid process i.e., in case 1a (Fig 1), two cases of degenerative joint disease i.e., in case 1c and 1e and one case of synovitis i.e., in case 1b respectively.The lesions encountered in degenerative joint disease were loose osteophytes, hyperemia of the synovial membrane with villus synovial reaction and discoloration of the articular surface with cartilage fibrillation [2,16].The lesions encountered in osteochondritis dissecans revealed hyperemia of the synovial membrane and a loose cartilage flap [5,14].In case of fragmented medial coronoid process arthroscopic lesions appeared as fibrillations on the medial coronoid process and also an elevated fragment on the medial coronoid process. Similar lesions have also reported on arthroscopic examination of elbow joint in synovitis [5,9,14]. In case of synovitis, the lesions encountered were hyperemic synovial membrane with proliferation of synovial villi.[3](Table 1).Thus reported lesions encountered in present study confirm the findings of earlier reports.

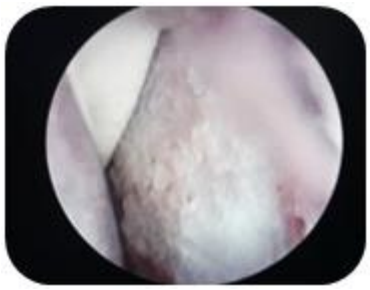

Figure 1: Arthroscopy of elbow showing fragmented medial coronoid process

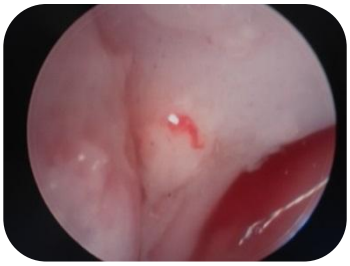

Figure 2: Arthroscopy of elbow showing osteochondritis dessicans

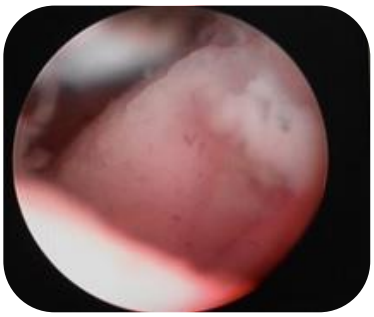

Figure 3: Arthroscopy of Hip showing osteoarthritis

Figure 4: Arthroscopy of Hip showing craniodorsal hip dislocation

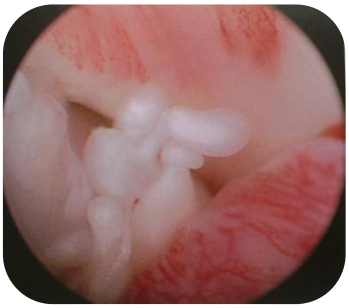

Figure 5: Arthroscopy of stifle showing cranial cruciate ligament rupture

Figure 6: Arthroscopy of stifle showing osteochondritis dessicans

Based on the observations of the present study as well as the findings of the previous studies suggests that arthroscopy is highly sensitive and relatively specific for localization and characterization of elbow joint lesions in dogs[2,15,17]

Arthroscopic examination of 6 affected hip joint cases revealed neovascularization and femoral head remodeling intwo cases i.e., in case 2a and 2f, severe osteoarthritic changes of femoral head in two cases i.e., in case 2c and 2e (Fig 3), craniodorsal hip dislocation in one case i.e., case 2d (Fig 4) and synovitis of hip joint with early remodeling changes in one case i.e., case 2b.The arthroscopic lesions encountered in hip dysplasia were mild wear of articular cartilage with femoral head remodeling. Arthroscopic changes seen in hip osteoarthritis included severe cartilage wear, fibrillation and femoral head remodeling. Arthroscopic changes in hip dislocation included mild labral tear with round ligament rupture. Arthroscopic changes in synovitis included hyperemic synovial villi with early remodeling changes. In the present study, Arthroscopic examination accurately diagnosed all 6 cases of hip joint affections. Hematoma and torn femoral round ligament were common findings in cases of hip dislocation[2,7].Synovitis, wear of the cartilage of the femoral head, mild tear of the labrum and acetabular cartilage wear were common arthroscopic findings in hip dysplasia and osteoarthritis of hip [2].(Table 2).Thus reported lesions encountered in present study confirm the findings of earlier reports. Based on the observations of the present study as well as the findings of the previous studies suggests that arthroscopy is highly sensitive and relatively specific for localization and characterization of hip joint lesions in dogs. [1,2].Arthroscopic examination of the six cases of stifle affected dogs examined revealed two cases of cranial cruciate ligament rupture i.e., in case 3a and 3b (Fig 5), one case of synovitis i.e., in case 3c,one case of osteochondritis dissecans i.e., in case 3d (Fig 6) and two cases of osteoarthritis i.e., in case 3e and 3f. The lesions encountered in two cases of cranial cruciate ligament injury were hyperemia of the synovial membrane, fibrillation of meniscus adjoining the tear, ruptured strands with loss of cross striations and pannus of the articular cartilage [10,17].The lesions encountered in osteochondritis dissecans were an attached, loose cartilage flap along with villus synovial reaction [2,17].Osteochondrosis dissecans of the lateral femoral condyle in two dogs was reported on arthroscopy by Rezende*et al.* (2006).Arthroscopic lesions visualized in one case of synovitis included hyperemic synovial membrane with proliferation of synovial villi [13,17]. Further, Synovitis was observed in three cases [10, 13].Arthroscopic lesions visualized in two cases of osteoarthritis included neovascularization with articular changes, osteophyte formation and subchondral bony changes and fibrillations [8].(Table 3).Earlier studies also indicated that arthroscopy could be used to accurately diagnose cases of cruciate ligament ruptures, collateral ligament ruptures and osteochondritis dessicans which are otherwise not visible on radiography. This concurred with the present findings.

6. Conclusion

The present study reveals that arthroscopy allowed better visualization of intra-articular surfaces and structures and provided finer details of the synovial membrane and articular cartilage damage. Arthroscopy added with magnification and coupled with joint irrigation also made it possible to appreciate the articular cartilage in detail as the synovial villi were suspended in the fluid medium and project into the joint cavity. Arthroscopy was also highlyuseful in the accurately diagnosingvarious joint lesions like ligament ruptures, labral tears and osteochondral defects in the joint that are not visible on radiography and also was very useful in detecting early changes like synovial villi inflammation which may be a sign of joint disorder where conventional radiography failed to detect it. Arthroscopy of the elbow, hip and stifle joints also provided a significant advantage over radiography in unraveling the lesions in dogs with joint disorders. Hence it is a superior technique for diagnosing elbow, hip and stifle joint lesions.

7. Future Scope

As arthroscopic technology has advanced, the scope of treatable conditions has expanded. Today, virtually every joint can be accessed via arthroscopy. Surgical arthroscopy evolved into a major therapeutic modality, rather than merely a diagnostic tool. No longer would patients have to undergo debilitating and painful surgery with extensive incisions. When indicated, arthroscopy would become the preferred method of surgical treatment over conventional, old-fashioned procedures. A three dimensional vision would be great, especially in cruciate ligament reconstructive surgery. Furthermore, a manual movable optic, which can be turned from 0° to 90°, would help the surgeon significantly. For 20 years, the industry has been trying to develop these scopes, but till now it has not been of any practical use. VRATS – Virtual-Reality-Arthroscopy-Trainings simulator are coming up, but are not yet used.

Table 1: Arthroscopic findings in 6 cases with elbow joint disorders

Cases	Breed	Age	Gender	Arthroscopic findings
1a	Labrador Retriever	10 months	Male	Fragmented coronoid process
1b	Non-Descript	2 Years and 5 months	Male	Hyperemia of the synovial membranes indicating synovitis
1c	Labrador retriever	7 years and 4 months	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the Humeral condyle
1d	German shepherd	1 year and 2 months	Female	Loose cartilage flap with hyperemia of synovial membrane
1e	Golden retriever	8 years	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the humeral condyle
1f	Non descript	1 year	Male	Loose cartilage flap with hyperemia of synovial membrane

Table 2: Arthroscopic findings in 6 cases with Hip joint disorders

Cases	*Breed*	*Age*	*Gender*	*Arthroscopic findings*
2a	Labrador retriever	8 months	Male	Swelling and neovascularization of the teres ligament and femoral head remodeling
2b	Non descript	4 years	female	Synovitis with early remodeling changes
2c	Neopolitan mastiff	6 years and 5 months	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the femoral head
2d	Non descript	3 years	Male	Craniodorsal luxation with labral tears and round ligament rupture
2e	Labrador Retriever	8 years and 3 months	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the femoral head
2f	Labrador retriever	9 months	Male	Neovascularization of articular cartilage and remodeling of the femoral head

Table 3: Arthroscopic findings in 6 cases with stifle joint disorders

Cases	*Breed*	*Age*	*Gender*	*Arthroscopic Findings*
3a	Pug	2 years and 5 months	Male	Cranial Cruciate Ligament rupture
3b	Non descript	1 year and 5 months	Female	Osteochondral flap with Cranial cruciate ligament rupture
3c	Labrador retriever	3 years and 7 months	Male	Synovitis with fibrillation of the articular cartilage, neovascularization and remodeling of the stifle joint
3d	Golden retriever	1 year and 3 months	Male	Loose cartilage flap with hyperemia of synovial membrane
3e	Labrador retriever	6 years and 5 months	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the stifle joint
3f	Labrador retriever	7 years and 3 months	Male	Fibrillation of the articular cartilage, neovascularization and remodeling of the stifle joint

References

[1] Baber, Y.F., Robinson, A.H.N. and Villar, R.N., 1999. Is Diagnostic arthroscopic of hip worthwhile? *J. Bone. Joint. Surg;* **81**: 600-603.
[2] Beale, B.S., Hulse, D.A., Schulz, K.S, and Whitney, W.O., 2003. Arthroscopically assisted surgery of the elbow joint. In: Small animal arthroscopy, Philadelphia: WB Saunders. pp. 50-79.
[3] Botazzoli, A.F., Ferraresi, F., Travetti, O.,Martini, F.M., Mortellaro, C.M., and De Giancemello. M., 2009.Elbow dysplasia and lesions of the medial coronoid process: correlation between tomographic and arthroscopic findings in thirty cases. *Vet. Res. Commun.*, **32**:247-249.
[4] Bumun, A., Kaya, U., Temuzsoylu, D., Kubar, M., Alkan, Z. and Saulam, M.,2002. The Clinical, Radiographical and Arthroscopical Diagnosis of Cranial Cruciate Ligament Lesions and Surgical Therapy in Dogs.*Turk. J. Vet. Anim. Sci.*,**26**: 397-401.
[5] Fitzpatrick, N., Smith, T. J., Evans, R. B. and Yeadon, R., 2009. Radiographic and Arthroscopic findings in the elbow joints of 263 dogs with Medial Coronoid Disease.*Vet. Surg.*, 38:213-223.
[6] Hall, M.E. And Keeran, R.J., 1975. Use of the arthroscope in the horse.*Vet. Med. Small Anim. Clin.*, **70**:705.
[7] Heo, S.Y., and Lee, H.B.,2013. Minimally Invasive Arthroscopic-Assisted Reduction with Tight-Rope in a Dog with Coxofemoral Luxation. Pak. Vet. J**., 40**:1-5.
[8] Hulse D.A., and Beale B.S ., 2000. Second Look Arthroscopic findings after tibial plateau levelling osteotomy.*Vet. Surg*; **39**:350-354.
[9] Komsta, R., Dębiak, P., and Twardowski, P., 2008. Radiographic evaluation of joints in dogs with elbow dysplasia – clinical observations. *Bull. Vet. Inst. Pulawy.*,**52**:179-183.
[10] Mahn, M.M., Cook, J. L. Cook, C.R. and Balke, M.T., 2012. Arthroscopic verification of ultrasonographic diagnosis of meniscal pathology in dogs.*Vet. Surg.*,**34**: 318-323.
[11] Morgan, J.P., 1972. Radiological Pathology and Diagnosis of Degenerative Joint Disease in the Stifle Joint of the Dog.*J. Small Anim. Pract.*,**10**:541–544.
[12] Person, M.W., 1985. A procedure for arthroscopic examination of the canine stifle joint. *J. Am. Anim. Hosp. Assoc.*, **21**: 179-186.
[13] Rezende, C.M.F., Melo, E.G., Madureira, N.G. And Freitas, P.M., 2006.Arthroscopy of stifle joint in dogs.*Arq.Bras. Med. Vet. Zootec*.,**58:** 841-848.
[14] Tatarunas. A.C and Matera, J.M 2006. Arthroscopic study of the elbow joint in dog cadavers.*Acta Cir. Bras*.**21**:1-8.
[15] Van Ryssen, B. and Van Bree, H., 1997. Arthroscopic findings in 100 dogs with elbow lameness. *Vet. Rec.*, **140**: 360-362.

[16] Vermote K.A.G., Bergenhuyzen, L.R., Geilen, I., Van Bree, H., Duchateau, L. and Van Ryssen, B., 2010. Elbow lameness in dogs of six years. *Vet. Surg.*,**31**: 125-132. [17]Vishal B.N., 2011. Arthroscopic study of elbow and stifle joint in dogs.MVSc. Thesis.Karnataka Veterinary Animal and Fisheries Sciences University, Hebbal, Bangalore.

[17] Wind, A.P. and Packard, M.E., 1986. Elbow incongruity and developmental elbow diseases in the dog. *J. Am. Anim. Hosp. Assoc.*, **22**: 725-730.

Author Profile

Dr. Anirudh. Ajjampur completed his B.V.Sc from Pondicherry university in 2009 and M.V.Sc in Veterinary Surgery and Radiology from Madras Veterinary College, TANUVAS, Chennai in 2011 and is currently pursuing his ph.D in Veterinary Surgery and Radiology at Veterinary College, KVAFSU, Bangalore. His area of interest is Veterinary orthopedics and soft tissue surgery.

Dr. L.Ranganath completed his B.V.Sc in 1985 and M.V.Sc in Veterinary Surgery and Radiology in 1991 from University of Agricultural Sciences, Bangalore. He obtained his Ph.D. from TANUVAS, Chennai in 1998. He is currently serving as the Professor and Head, Department of Veterinary Surgery and Radiology, Veterinary College, KVAFSU, Bangalore. He is having 30 years of teaching and research experience in Veterinary Surgery. He has guided 40 Postgraduate scholars and he has 200 international and National research publications. His area of interest is imaging, orthopedics and laparoscopic surgery.