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RESEARCH ARTICLE

PROSPECTIVE RANDOMISED STUDY COMPARING ENDOSCOPIC DISCECTOMY WITH PERCUTANEOUS RADIO-FREQUENCY COABLATION IN PATIENT WITH CONTAINED LUMBAR DISC PROLAPSE

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Abstract

Background: This study is to compare functional outcome in patients with radiculopathy with contained lumbar disc prolapse treated with endoscopic discectomy and percutaneous radio frequency co ablation. In this study, the radicular pain using VAS score and prospective functional results using SLR test were measured.

Materials and Methods: Prospective randomised control study carried out in Department of Orthopaedics from the period Nov 2016 to Nov 2018. Source of data for study was the patients reporting to Orthopaedic OPD who fulfill the inclusion criteria. Total 30 patients were included in the study. Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Inter group comparison (2 groups) was done using Mann Whitney U test. Intra group comparison was done using Wilcoxon Signed rank test (upto 2 observations); Friedman's (for >2 observations) followed by pair wise comparison using Wilcoxon Signed rank test.

Results: The functional outcome in patients treated with radiofrequency coablation are better than patients treated with endoscopic discectomy.

Conclusion: Both Radio-frequency co-ablation and percutaneous transforaminal endoscopic discectomy appear to be safe and effective minimally invasive day care treatment option for patients with contained lumbar disc prolapse with radiculopathy.

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Introduction:-

Lumbar disc prolapse causing radicular pain is a common problem. Painful abnormality of disc is usually caused by herniation of nucleus pulposus due to inflammation or compression of nerves.

These patients usually present with sudden onset lower extremity pain.

About sixty to eighty percentage of patient with acute painful disc herniation get better with 4-8 weeks without any treatment and those patients who failed to conservative therapy are opted for surgical procedures.⁽²⁾

Endoscopic disc surgery⁽³⁾ is relatively well known technique, which has been introduced since 80's

The concept behind it is to provide minimally invasive approach to lumbar spine when treating disc herniation. Endoscopic discectomy⁽⁴⁾ has advantages in providing clear visualisation of normal and pathological tissues and minimising damage to adjacent tissue, with preservation of normal structures.

Radio-frequency co-ablation⁽⁵⁾ is minimally invasive procedure for disc decompression that utilises patented coablation technology for ablating and coagulating the intervertebral disc. Advantage of this technique is that this procedure provides controlled and highly localised ablation, resulting minimal collateral damage to surrounding tissue.

Approximately 90% of lumbar disc herniation occurs at L4-L5 or L5-S1. 93% are inside the spinal canal and 3% are predominantly located in intervertebral foramina and 4% extra foraminal.⁽¹⁾ In 1963 Dr. Lyman W. Smith⁽⁶⁾ performed the first chemonucleolysis. In 1991, Dr Choy⁽⁷⁾ introduced Percutaneous laser discectomy. In 2002, Singh V⁽⁸⁾ conducted the study and Clinical outcome data was analysed for 67 patients with contained disc herniation who underwent percutaneous disc decompression-procedure using Coblation.

In 1983, Kambin⁽⁹⁾ initiated percutaneous indirect spinal canal decompression by nucleotomy using the Craig cannula through a posterolateral extra canal nonvisualised approach. Kambin and Gellman reported a 72% success rate for 136 patients treated with a percutaneous lateral technique. In 2007, Tzaan et al⁽¹⁰⁾ did this study and they analysed and presented their experience of performing transforaminal percutaneous endoscopic lumbar discectomy (TPELD). No major neurovascular injuries or deaths occurred. They concluded that in experienced hands, TPELD is minimally invasive, safe and effective for treating soft contained lumbar disc prolapse.

Methodology:-

This study was prospective randomized control study which was carried out in Department of Orthopaedics from the period Nov 2016 to Nov 2018. Total 30 patients were included in the study.

Inclusion criteria were as follows:-

1. Concordant clinical signs to CT, MRI, positive SLRT, sensory signs,
2. Herniation by posterior ligament not greater than 1/3rd of the sagittal diameter of the spinal canal,
3. 4 weeks of failed conservative treatment
4. Without neurodeficit.

Exclusion criteria were as follows:-

1. With neurological deficit
2. Extruded, sequestered herniation (MRI- direct neural decompression),
3. Severe stenosis, Severe degenerative disc disease with end stage collapse >50%,
4. Fracture, tumour, discitis
5. Fixed motor deficit
6. Cauda equina syndrome

The preoperative visual analogue scale (VAS) (a 100-point scale, with point 0 representing no pain and point 100 representing worst pain imaginable) and SLR test before the procedure were also recorded.

Both procedures (i.e endoscopic discectomy and radiofrequency coablation) were done under local anesthesia. The patient remained awake and thus could tell the surgeon pain caused by the nerve irritation.

Local anaesthesia was supplemented by intra venous sedation so as to keep the patient relaxed. Two doses (one pre procedure and one 12 hours post procedure) of Injection Cefoperazone + Sulbactam 1.5 gm were given to all patients

Positioning -The patient was placed in prone position on spine frame/bolsters on a fluoroscopy compatible table allowing easy antero-posterior and lateral positioning of C arm. The head rests on a pillow. Hip and knee of the patient was kept in flexion so as to obliterate the lumbar lordosis.

A) Radio frequency coablation

Radiofrequency coablation utilises the Perc-D SpineWand, which is a 1mm diameter bipolar instrument designed for decompression of the disc nucleus utilising both energy and heat.

The tip of the wand has a slight C curve to allow for channeling. The wand is connected to the standard Arthrocare power generator. This process generates a unique low temperature plasma field, for precise, controlled ablation with minimal risk of thermal injury. This creates a channel from the posterolateral annulus to the anteromedial annulus.

On the withdrawal, the coagulation mode is used. After positioning the patient Involved disc space was localised under fluoroscopic guidance. The midline is marked, disc space in antero-posterior view is marked, Disc space in lateral is marked, a point about 10 to 12 cm from midline is marked on the AP disc line, a perpendicular line from this point towards the lateral view disc line and the point where it intersects the lateral view disc line is skin the entry point for the wand (image 1). The soft tissue tract of the wand is infiltrated with local anaesthetic agent. 17 gauge needle introduced in to the postero-lateral corner of disc space using posterolateral extra pedicular approach. AP and lateral projection was checked to determine that the needle has not transmigrated the trans pedicular line (image 2 and image 3) 17 gauge needle then introduce through annulus and lumbar spine wand is inserted through this needle up to pre marked level and total of 6 channels are created at 2,4,6,8,10 and 12 o clock position using ablation mode and at rate of 6 sec/channel. On completion, instill antibiotics in to disc and then remove wand and needle.

B).Endoscopic Discectomy

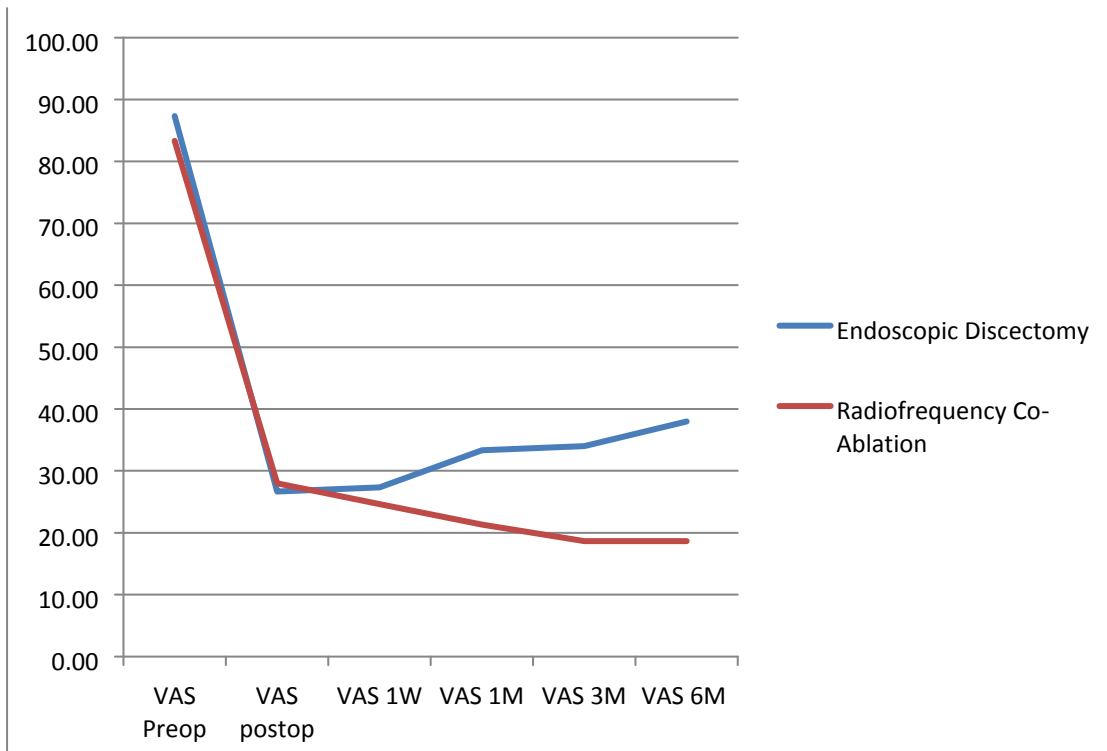
Procedure- Patient positioning and skin entry point determination was same that described for the radiofrequency co-ablation (image 1) .Needle is directed 10 degrees downwards to make 10 degree angle with upper and lower end plates respectively and advanced further till first bony resistance of facet is encountered in C-arm anteroposterior (AP) view, minor adjustment of trajectory can be done by bevel of needle, by keeping it up allows to go more superficially and vice-versa. Now under lateral view of C-arm withdraw needle little bit, elevate it and insert into the foramen by grazing the facet. Most important point is safe and precise landing into the lower part of Kambin's triangle. Use of local anaesthesia agent (according to BW of patient) into the foramen to make the procedure more comfortable. Site of annular puncture is medial pedicular line in Antero-Posterior view and posterior vertebral line in lateral view in lower lumbar spine as lamina is wider so chance of dural puncture is less and mid pedicular line in upper lumbar levels as lamina is narrow so chances of dural puncture is higher. Now pierce the annulus(feels like rubber stopper). Replace the needle with guide wire and obturator passed over guide wire till it pierce annulus. Remove the guide wire and thread the working cannula over obturator with help of mallet & tapper. Remove the obturator and introduce the endoscope through the working cannula. During a procedure watch for any undue pain radiating to the limb which is indicative of compression over exiting root (traversing root protected by facet) and change the needle trajectory accordingly. After introduction of endoscope try to identify the structures like epidural fat, annular tear with nuclear caught fragment, posterior longitudinal ligament, transversing nerve root, exiting nerve root, superior facet and superior and inferior pedicalnotches. Remove the fragment with different types of forceps. Free movement of thecal sac and traversing root, fresh epidural bleeding, and subsidence of pain are the signs of an adequate decompression.

Outcome And Results:-

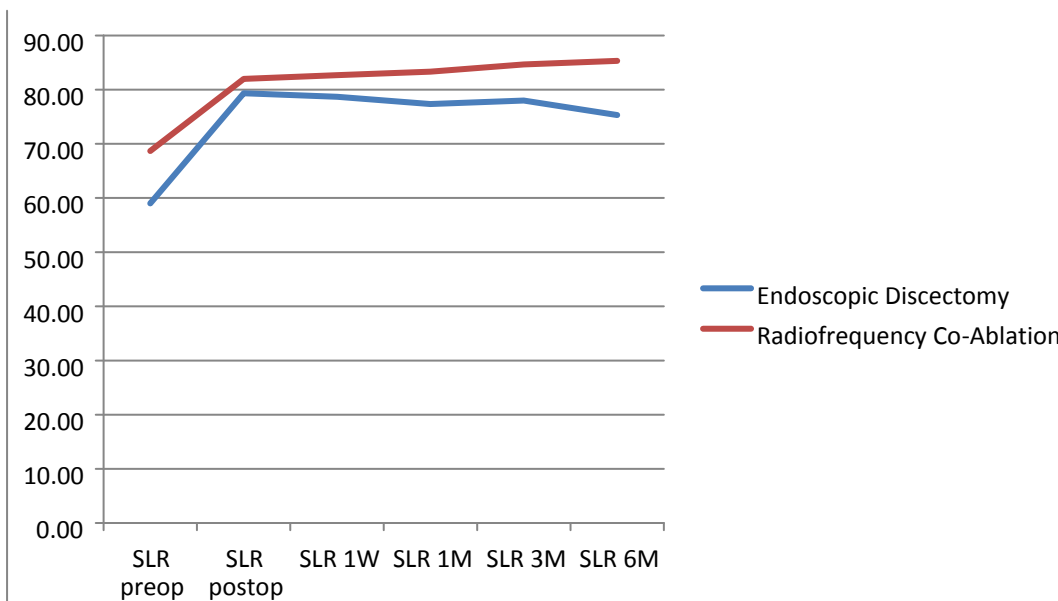
Total 30 patient were included in this study out of which Group 1(total 15 patient) underwent endoscopic discectomy & Group 2(total 15 patient) underwent Radiofrequency co ablation.

All patients were evaluated pre-operatively and post operatively at immediate post op, 1 week, 1 month, 3 months and 6 months post operative with using Visual analogue scale (VAS) and straight leg raising test (SLR).

Age of our patients ranged from 23 yrs to 45 yrs. This study involved 19 males(63.3%) and 11 females(36.7%) with mean age 33 years(23 to 45 years). There is no statistically significant difference between the gender, age and outcome of the procedure.



This Graph shows that pre op VAS score for group 1 was 87.33(mean) and after procedure immediate post op VAS score was 26.7(mean) and 6 month post op was 38 (mean) which shows reduction in VAS score after procedure in group 1, also pre op VAS score for group 2 was 83.33 (mean) and after procedure immediate post op VAS score was 28 (mean) and 6 month post op was 18.67(mean) which shows reduction in VAS score after procedure. The reduction in VAS score is more in group 2 which signifies that patients are better relieved from radicular pain after radiofrequency co ablation.



This graph and line diagram shows that pre op SLR in group 1 was 59 degree (mean) and improved immediate post op with 79.33 degree (mean) while the post op 6 months was 75.33 degree (mean). Pre op SLR in group 2 was 68.67 degrees(mean) with improved immediate post op 82 degrees (mean) and further improved to 6 months post op to mean 85.33 degrees.

Discussion:-

The purpose of this study was to evaluate the techniques that would provide maximum benefit with minimal damage to the surrounding neural and musculoskeletal structures. Open lumbar microdiscectomy is considered gold standard for treatment of disc prolapse with a reported success rate of 80%. However, employment of endoscopic technique through a percutaneous approach can further cut down on the surgical morbidity while achieving similar or better outcomes.

Shay shabat et al¹¹ reported results of radiofrequency co ablation for radicular pain alone or in combination with mechanical low back pain. He found that the patients had a substantial reduction in pain after the procedure of Radiofrequency co ablation. After 1-year follow-up, 63% of the patients still showed significant improvement.

Ferass Al-Zain¹² found that 73% of treated patients with radiofrequency co ablation experienced an improvement of more than 50% in their symptoms in the early post-operative VAS score and this was reduced to further 61% at 6 months post-operatively which signifies that there is significant reduction in VAS score after Radiofrequency co ablation which correlate with our results.

Hui Zhu et al¹³ evaluated the efficacy of Radiofrequency co ablation in contained lumbar disc prolapsed; he found that evaluation of the 42 patients demonstrated significant improvement rate of VAS.

Choi G¹⁴ did a Percutaneous endoscopic interlaminar discectomy in 67 patients, they found that VAS for leg pain (preoperative mean, 7.89; postoperative mean, 1.58) showed statistically significant ($P = 0.00$) improvement in their values at the last follow-up examination compared with preoperative scores, and concluded that percutaneous endoscopic interlaminar discectomy is a safe, effective, and minimally invasive procedure

In 2016 Ying Jet al¹⁵ did a randomized study with endoscopic discectomy in patient with lumbar disc prolapse, he found that postoperative

VAS scores significantly decreased after surgery ($P < 0.001$), The follow-up continued 1 year. With increasing length of follow-up, the disparities in clinical outcomes were gradually narrowing.

Sarang Gotecha¹⁶ did a endoscopic discectomy on 120 patients who had single level herniated disc, he found that mean preoperative and 6 months follow-up VAS score was 8.4 and 1.89 respectively. They concluded that TPELD can be a reasonable alternative to conventional microscopic discectomy for the treatment of patients with LDH.

In 2017, Kim HS¹⁷ did a analysis of clinical results of three different routes (foraminal, intervertebral, and suprapedicular) of percutaneous endoscopic transforaminal lumbar discectomy for lumbar herniated disc. The preoperative VAS score decreased significantly ($P < 0.01$) in all 3 groups, but the postoperative VAS score was higher for the foraminal route than for the intervertebral ($P = 0.001$) and suprapedicular routes ($P < 0.001$).

Conclusion:-

Both Radiofrequency co-ablation (Nucleoplasty) and percutaneous transforaminal endoscopic discectomy appear to be safe and effective minimally invasive day care treatment option for patients with contained lumbar disc prolapse with radiculopathy, providing rapid recovery in well selected patient. Both Radiofrequency co-ablation and endoscopic discectomy have good early results. VAS score is good indicator to assess pre op and post op status of patient undergoing procedure. The results indicate that there was some increase in VAS in the endoscopic discectomy group at the end of 6 months and that as compared to the radiofrequency group the difference was statistically different between the two groups. The reduction in VAS score is more in group 2 which signifies that patients are better relieved from radicular pain after radiofrequency co ablation.

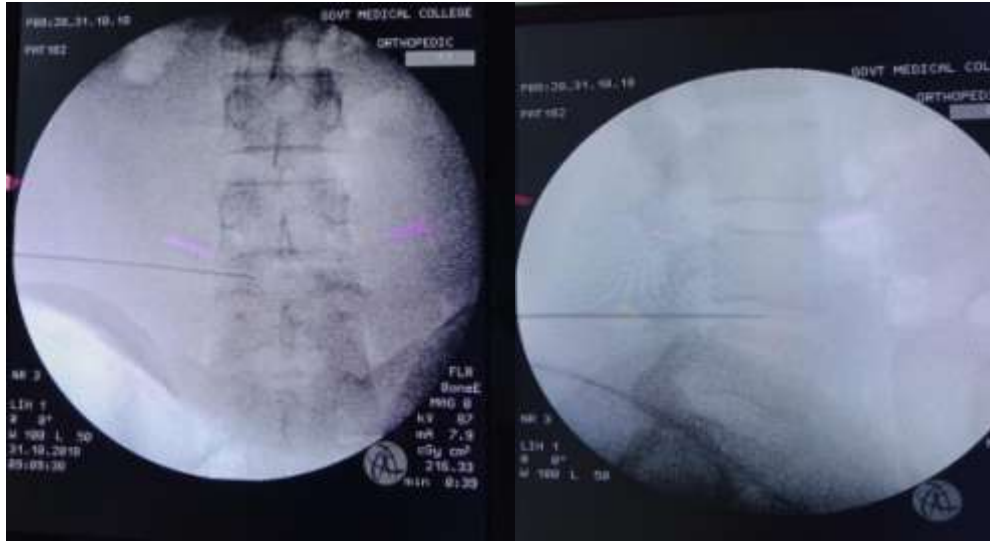


Image 2:-

Image 3:-



Image 1:-

Image 4:-

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