



A PROSPECTIVE STUDY OF THE FUNCTIONAL AND CLINICAL RECOVERY FOLLOWING LUMBAR FENESTRATION DISCECTOMY

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ABSTRACT **Purpose:**-Fenestration technique for removal of the lumbar disc has certain distinct advantages like early postoperative mobilization, early return to work, and low incidence of postoperative backache and is free from spinal instability. The purpose is to Study the Extent of functional recovery (i.e. pain relief and return to work), clinical and neurological recovery in patients with lumbar disc prolapse treated by fenestration technique. **Methodology**-30 patients in the age group 20-60yrs of both genders following a strict inclusion criteria, with Disc prolapse and sensory or motor deficits on clinical examination and pre-operative imaging with X-ray and MRI underwent Fenestration discectomy. The Visual analogue score, intra-operative and post-operative complications and modified Oswestry disability index were used as parameters for evaluation. Patients were followed up at 3weeks, 6weeks and 12weeks. **Results**-The most common level of involvement was (L4-L5) followed by (L3-L4) (L5-S1) 11 patients had moderate disability while, 13 had severe disability and 6 had crippling disability according to modified Oswestry disability index. The duration of average post-operative hospital stay was 5 days. 15 patients post-operatively improved with a minimum disability score and 13 with a moderate disability score and was mobilized within 22hrs post-operatively and returned to work within 6 weeks and regained their pre-operative functional status. 2 patients complained of persistent mild back pain, while 1 patient had intra-operative Dural tear which was managed intra-operatively and patient is asymptomatic and returned to work with minimal disability.**Conclusion**-The results of the study shows that most patients fall into minimal disability following surgery and return to work within 6 weeks. Fenestration discectomy is an effective and reliable surgical technique for treating properly selected patients with herniated disc at L3-L4, L4-L5 and L5-S1 to improve the functional and clinical recovery levels.

KEYWORDS : Fenestration, Discectomy, Postoperative Pain, Oswestry disability index

Introduction:

The incidence in the general population of low back pain as a presenting complaint is approximately 2%^(1,2). It is estimated that up to 70% to 80% of the population will experience back pain at some time in their life. The annual prevalence of low back pain ranges from 15% to 45% but is largely dependent on the population being studied and surveillance methods. The 2010 Global Burden of Disease Study estimated that low back pain is among the top 10 diseases and injuries that account for the highest number of DALYs worldwide. The people affected are most commonly below 40years who are in economically productive age group. Hence, Low back pain affects the socio-economic status of a region significantly.^(1,2,3)

Lumbar disc prolapse is the major cause of low back pain leading to severe morbidity throughout the world. The Lumbar disc prolapse occurs after degeneration of intervertebral disc and it's more common at L4-L5 and L5-S1 levels. L3-L4 and L2-L3 levels accounts for the majority remaining herniations. Degeneration of disc due to various factors leads to prolapse of intervertebral disc into intervertebral foramina especially into L4-L5 and L5-S1 level. Swenson and Anderson noted Psychological variables associated with low back pain to be dissatisfaction with work environment and a higher degree of worry and fatigue at the end of the workday.⁽⁴⁾

The presence of radicular pain and other symptoms depend on the site and degree of herniation. Detailed history and clinical examination supplemented by relevant radiological investigations can differentiate herniated lumbar disc prolapse from other causes of low back pain and sciatica.

Surgical removal of offending disc offers a simple and effective solution in management of severe sciatic pain and this method has established its position as reasonably safe procedure with satisfactory results in most of the patients. The traditional extensive laminectomy and discectomy went into disrepute because of extensive disruption of

posterior stabilizing structures of spine and its later complications.⁽⁵⁾ Fenestration technique for removal of the lumbar disc has been in use for a number of years. It has certain distinct advantages over the more commonly used laminectomy technique of disc excision. Love described extradural removal of herniated disc and devised interlaminar fenestration for treatment of lumbar disc prolapse. The advantages of fenestration and interlaminar approach have been demonstrated.⁽⁶⁾

Mishra et al compared laminectomy and fenestration for disc excision and concluded the superiority of latter approach in respect to early postoperative mobilization, early return to work and low incidence of postoperative backache as it is less extensive. It is very safe, effective and reliable surgical technique for treating properly selected patients with herniated disc. This approach is free from spinal instability and membrane formation resulting from laminectomy.⁽⁷⁾

The aim of the present report is to analyze the results of cases of lumbar disc prolapse, operated by fenestration technique, to assess the suitability of this technique in disc excision and to identify the factors affecting the final functional results.

Methods:

Subjects who have sustained an Intervertebral Disc Prolapse and are admitted to RajaRajeswari Medical College and Hospital, Bangalore satisfying the inclusion criteria are taken for this study.

Study Design – A Prospective Analytical study

Study Period – Cases satisfying the inclusion criteria admitted at RajaRajeswari Medical College and Hospital, Bangalore during the study period of November 2019 to May 2021 will be included.

Sample Size Estimation - The Sample Size is 30 and is calculated based on previous studies as well as approximate availability of

number of cases in the above mentioned duration satisfying inclusion and exclusion criteria.

Methods of collection of data (including sampling procedures if any)

All cases meeting the inclusion criteria of both sex presenting with Intervertebral Disc Prolapse coming to the Hospital attached to Rajarajeswari Medical College and Hospital, Bengaluru.

Inclusion Criteria:

Patients with clinically and radiologically diagnosed lumbar disc prolapse with following indications:-

- a) Disc prolapse with severe sensory or motor deficits.
- b) Disc prolapse with progressive neurological deficits.
- c) Disc prolapse with sciatica (unilateral or bilateral sciatica) which is decreased by conservative measures (rest, anti-inflammatory medication, physiotherapy or even epidural steroids) but returned to the initial levels after a minimum of 6-8 weeks of above-mentioned conservative measures.

- e) Age group of 20-60 years.
- f) Failure of conservative treatment.

Exclusion Criteria:

- a) Lumbar Disc Prolapse other than L3-L4, L4-L5 and L5-S1
- b) Far lateral disc prolapse compressing the nerve in the foramen as proved by CT scan or MRI
- c) Recurrent disc herniation's
- d) Spondylolisthesis

Period of follow-up:

The clinical follow up will be at 3weeks, 6weeks and 12weeks, regarding functional outcome.

Parameters for evaluation:

- Visual analogue score
- Intra-operative and Post-operative complications
- Oswestry disability index

ETHICAL CLEARANCE: Obtained from the institutional ethics committee.

Statistical tests: The collected data will be evaluated using appropriate statistical methods the categorical variables will be described by means of frequency and percentages and presented graphically whenever necessary.

For quantitative data it will be described using descriptive statistics means and 95 percent confidence interval and will be presented graphically whenever necessary. The Student's t-test will be used for normally distributed data and the Mann-Whitney U test for ordinal data. P value ≤0.05 will be considered statistically significant.

STUDY METHOD:

Cases selected from the patients with Intervertebral Disc Prolapse who require Discectomy, after taking consent, will be analyzed clinically and radiologically. All the patients selected for the study will be examined according to protocol, clinical and laboratory investigations will be carried out in order to get fitness for surgery. Patients will be subjected to Fenestration Discectomy. Post-operated patients will be followed up for 3 weeks, 6 weeks and 12 weeks.

PRE-OPERATIVE WORK-UP:

This study required surgical intervention to be conducted on humans and the following investigation:

1. Basic surgical evaluation for surgery
2. X-ray of the lumbo sacral spine in antero-posterior & lateral views.
3. Chest X-ray.

Special investigations:

1. HbsAg, HIV 1 and 2 testing,
2. ECG
3. MRI of Lumbo- sacral spine.

Before subjecting the patients for investigations and surgical procedures written/informed consent were obtained from each patient. All the investigations and surgical procedures were undertaken under the direct guidance and supervision of my guide.

All the patients were operated with identical approach & surgical technique.

DATAANALYSIS:

The collected data was coded and entered onto Microsoft Excel compiling the master chart. Descriptive statistics were done for all data and reported in terms of mean values and percentages. Suitable statistical tests of comparison were done. Continuous variables was analyzed with the paired t test and ANOVA single factor test. The results were expressed as proportion using appropriate tables and graphs.

Results:-

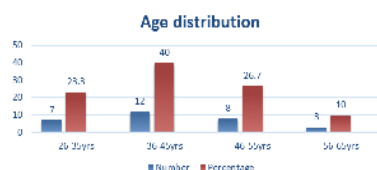
DEMOGRAPHY:

The age did not have any statistical significance on the outcomes of the study.

Table 1:- Age distribution of study participants

Age	Number	Percentage
26 to 35 Years	07	23.3
36 to 45 Years	12	40.0
46 to 55 Years	08	26.7
56 to 65 Years	03	10.0
Total	30	100.0

Fig No.1: Age distribution of study participants



In the study, 18 males & 12 females were included.

Table 2:- Distribution of study participants according to gender

Gender	Number	Percentage
Male	18	60.0
Female	12	40.0
Total	30	100.0

Fig 2:-Distribution of study participants according to gender

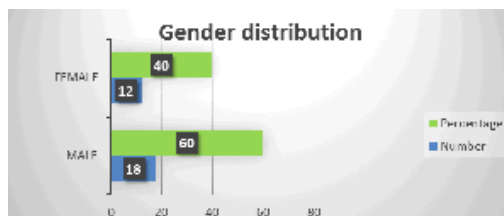


Table 3:-Distribution of patients according to side of radiculopathy

Side	Number	Percentage
Right	13	43.3
Left	12	40.0
Bilateral	05	16.7
Total	30	100.0

Fig 3:-Distribution of patients according to side of radiculopathy.

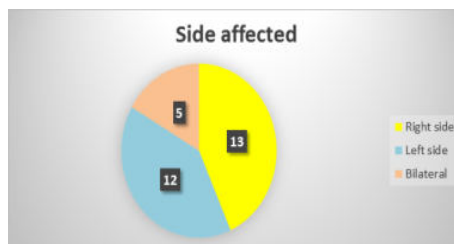


Table 4:-Distribution of study according to affected level ‘

Level	Number	Percentage
L3-L4	4	13.33

L4-L5	15	50
L5-S1	11	36.67
Total	30	100

Figure 4: Distribution of study according to affected level

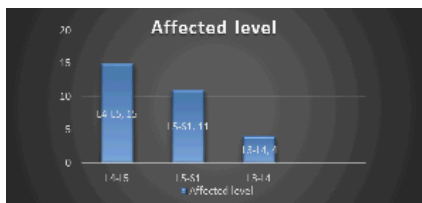


Table 5:-Comparison of Outcome between Pre-op and Post op score at 3, 6 and 12 weeks.

Vas Score	Mean	Std.Deviation	P Value
Pre-Op	6.40	1.07	
Post-Op 3 weeks	3.90	1.03	0.0001
Post-Op 6 weeks	2.33	0.76	0.0001
Post-Op 12 weeks	1.40	0.81	0.0001

Figure 5- showing outcome between Pre-op and Post-Op score at 3, 6 and 12 weeks

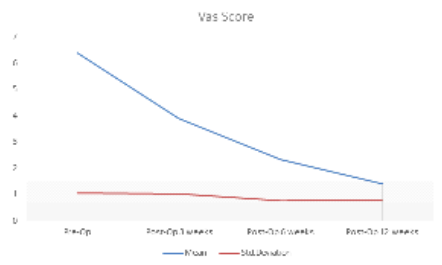


Table 6:-Number of complications associated with the study

Complications	Number	Percentage
Nil	29	96.7
Yes	01	03.3
Total	30	100.0

Fig 6:- Complications associated with the study

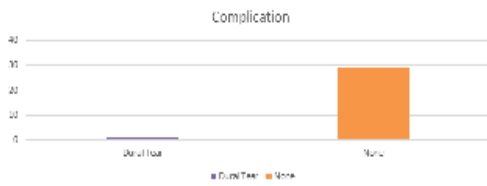


Table 7:-Time to mobilization

Mean	Standard Deviation
24.20	8.41

Fig 7:-Time to mobilization

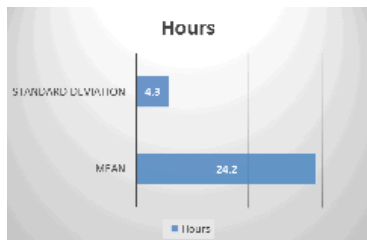


Table 8:-Disability Index score Pre op, and at 3, 6, and 12 weeks Post-Op

Disability Index Score	Mean	Standard Deviation	P Value
Pre	52.73	13.74	0.0001
Post 3 Week	38.40	12.11	
Post 6 Week	28.73	11.21	0.0001

Post 12 Week	21.60	10.99	0.0001
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Fig 8:-Disability Index Score Pre op and at 3,6 and 12 weeks Post-Op

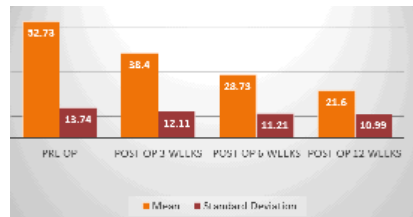
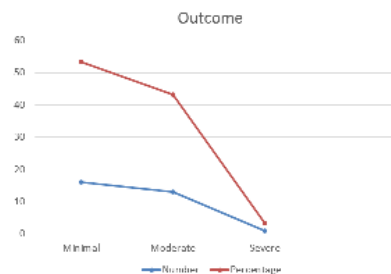


Table 9:-Outcome at 12 weeks according to the Disability Index Scale

Outcome	Number	Percentage
Severe	01	3.33
Moderate	13	43.33
Minimal	16	53.33
Total	30	100.0

Fig 9:-Outcome at 12 weeks according to the Disability Index Scale



Discussion:-

Back pain due to lumbar intervertebral disc prolapse contributes to the wide range of problems related to back pain. The lumbar disc disease though not contribute to mortality, it contributes to morbidity and economic loss due to the number of work hours lost. (1,2)

The end point of assessment of any therapeutic modality is functional outcome, because that is what matters to the patients. Lumbar disc disease being a benign condition and pain is the predominant factor limiting the activities of the patient, it is anticipated that after the therapy, the patients should have good functional outcome and go back to premorbid state. However, the fact is that the good outcome varies from 49-90% in different studies. This only implies that there should be many factors which influence the outcome. The factors that influence the outcome are:

Patient selection

The low back pain and radicular pain, though classical of lumbar disc disease, there are other conditions like lumbar plexitis, canal stenosis, spondylosis, lateral spinal foramen syndrome and spondylolisthesis etc., which have similar symptoms. It is also known that nearly 30% of people above the age of 30-40 years have incidental disc herniation's, which are more often seen in MRI. So one has to be very meticulous and cautious in selecting patients for surgery.

All patients of disc prolapse should have a period of conservative therapy before considering surgery unless there is gross neurological deficit or sphincter/ bowel disturbance. It is a well-known fact that majority of the patients make a good recovery following conservative therapy, hence any surgical intervention without appropriate conservative therapy leads to unnecessary surgery and so also to poor outcome. (1,8,9)

Investigation

The investigations primarily radiological, which has been used, has advanced from plain x-ray to MRI. To start with, the basic investigation used to be myelography with which one could diagnose disc herniation in 80-90% of patients. With the advent of CT scan, that too with intrathecal contrast, the diagnostic accuracy increased and disc herniation in certain locations like foraminal herniation and diagnosis of lateral canal stenosis could be made. The introduction of MRI gave a major boost to diagnosis as one could study the various

stages of disc degeneration, anatomical delineation is far superior, the ligamentum flavum could be imaged and extra foraminal disc herniation could be diagnosed. The MRI has also made great influence in diagnosis of postoperative complications. The advances in investigations have influenced the accurate diagnosis and results of the surgical outcome. The potential disadvantage is it overestimates the diagnosis of symptomatic disc prolapse. As we have discussed earlier, 30% of normal individuals have various stages of disc prolapse on MRI as an incidental finding.^(1,10,11)

Level of disc prolapse

It is very important to make sure that one is operating on pathological disc. This should be aided by per-operative C-arm or preoperative marker films. False disc level surgery leads to recurrence or non – relief of symptoms and its potential ethical complications.

Psychological/Functional Status

Use of Wadell's score is also very important in avoiding surgery in patients who have abnormal psychological behavior. Patients who have a score of 4 and above are more likely to have recurrence of back pain after surgery.

Any scientific study needs an objective evaluation of results when one does the literature survey of outcome of lumbar disc surgery, one will come across so many assessment scales e.g. Modified Stauffer Conventry scale, Loon's outcome criteria, PROLO scale etc. which are either difficult to practice and confusing or it may not be suitable for our population. In this study, we have selected Modified Oswestry disability questionnaire as these scales are simple which assess patients' outcome both clinically and functionally. It can also be used to assess the efficacy of different surgical procedures.⁽¹²⁾

Fenestration is a safe, effective and reliable method for treating selected patients with herniated lumbar discs. The amount of disc herniation's were assessed in MRI pre-operatively and on clinical analysis it was found that almost all of them fell in the minimal to moderate disability criteria, according to modified Modified Oswestry disability index score, post-operatively. No patients in this study deteriorated after surgery. The most common level of involvement was (L4-L5) followed by (L5-S1) and (L3-L4)

Six patients had moderate disability while, fifteen had severe disability and eight had crippling disability and one was bed bound according to modified Oswestry disability index.

Sixteen patients post-operatively improved with a minimum disability score, while thirteen had a moderate disability score and one had a severe disability score at 12 weeks post-operatively. Patient was mobilized within 24hrs post-operatively and returned to work within 6 weeks and regained their pre-operative functional status.

Two patients complained of persistent mild back pain, while one patient had intra-operative Dural tear which was managed intra-operatively and patient is asymptomatic and returned to work with minimal disability.

Age and Gender: In our study we have found that majority of the cases fall within 36-45 years of age. In the study of Matti Humme et al it was found that increasing age was an important negative predictor while many other studies including Webber's study has shown that age was not predictive of outcome.⁽¹³⁾

In our study there is no statistically significant difference in outcome between males and females or the age of the patient. In Weber study, female gender was associated with unsatisfactory outcome.⁽¹³⁾

Neurological deficit

Neurological deficit e.g. Motor deficit was not predictive of outcome as has been shown by previous studies (Spangfort study and Weber study).^(14,15)

TIME TO MOBILIZATION:

Mobilization following surgery was delayed for 12 hours following surgery in our institution. Mean time to mobilization was 24.2 hours.

Limitations

1) Since the study population was only confirmed to single level fenestration discectomy procedures at L3-L4, L4-L5 and L5-S1 levels other levels weren't considered.

- 2) Two level discectomy patients weren't considered.
- 3) Far lateral disc prolapse compressing the nerve in the foramen as proved by CT scan or MRI weren't considered.
- 4) Short duration of study with limited numbers.

Conclusion:

The results of the study shows that most patients improve from severe disability to minimal and moderate disability (as evaluated with modified oswestry disability index) following fenestration discectomy and return to work within 6 weeks. Fenestration discectomy is an effective and reliable surgical technique for treating properly selected patients with herniated disc at L3-L4, L4-L5 and L5-S1 to improve the functional and clinical recovery levels.

According to modified oswestry disability index the pre-operative symptoms and neurological signs did not have a significant effect on the outcome of fenestration discectomy.

Results of this study, state that the lumbar discectomy performed with a limited disc excision by fenestration is a safe, effective and reliable method for treating selected patients with herniated lumbar discs.

Fenestration provided early post-operative mobilization and return to job.

Tables
Table:-10

0% to 20%: minimal disability:	The patient can cope with most living activities. Usually no treatment is indicated apart from advice on lifting sitting and exercise.
21%-40%: moderate disability:	The patient experiences more pain and difficulty with sitting, lifting and standing. Travel and social life are more difficult and they may be disabled from work. Personal care, sexual activity and sleeping are not grossly affected and the patient can usually be managed by conservative means.
41%-60%: severe disability:	Pain remains the main problem in this group but activities of daily living are affected. These patients require a detailed investigation.
61%-80%: crippled:	Back pain impinges on all aspects of the patient's life. Positive intervention is required.
81%-100%:bed Bound	These patients are either bed-bound or exaggerating their symptoms

Figures: 13:- MODIFIED OSWESTRY DISABILITY INDEX

LOW BACK PAIN AND DISABILITY INDEX (REVISED OSWESTRY)

Patient Name: _____ Date: ____/____/____

Please read instructions carefully. This questionnaire has been designed to give the doctor information as to how your low back pain has affected your ability to manage everyday life. Please read all statements in each section and mark the box which most closely describes your problem.

SECTION 1 - PAIN INTENSITY

- The pain comes and goes and is very mild.
- The pain is mild and does not vary much.
- The pain comes and goes and is moderate.
- The pain is moderate and does not vary much.
- The pain comes and goes and is very severe.
- The pain is severe and does not vary much.

SECTION 2 - PERSONAL CARE

- I do not have to change my way of washing or dressing to avoid pain.
- I do not normally change my way of washing or dressing even though it causes some pain.
- Washing and dressing increases the pain but I manage not to change my way of doing it.
- Washing and dressing increases the pain and I find it necessary to change my way of doing it.
- Because of the pain, I am unable to do some washing and dressing without help.
- Because of the pain, I am unable to do any washing or dressing without help.

SECTION 3 - LIFTING

- I can lift heavy objects without any extra pain.
- I can lift heavy objects, but it gives extra pain.
- Pain prevents me from lifting heavy objects off the floor.
- Pain prevents me from lifting heavy objects off the floor but I can manage if they are conveniently positioned on a table.
- Pain prevents me from lifting heavy objects but I can manage light to medium objects.
- I can only lift very light objects at the most.

SECTION 4 - WALKING

- I have no pain on walking.
- I have some pain but it does not increase with distance.
- I cannot walk more than one mile without increasing pain.
- I cannot walk more than 1/2 mile without increasing pain.
- I cannot walk at all without increasing pain.

SECTION 5 - SITTING

- I can sit in any chair as long as I like.
- I can only sit in my favorite chair as long as I like.
- Pain prevents me from sitting more than one hour.
- Pain prevents me from sitting more than half an hour.
- Pain prevents me from sitting more than 15 minutes.
- I avoid sitting because it increases pain.

SECTION 6 - STANDING

- I can stand as long as I want without pain.
- I have some pain on standing but it does not increase with time.
- I cannot stand for longer than one hour without increasing pain.
- I cannot stand for longer than 1/2 hour without increasing pain.
- I cannot stand longer than 15 minutes without increasing pain.
- I avoid standing because it increases the pain.

SECTION 7 - SLEEPING

- I get no pain in bed.
- I get pain in bed but it does not prevent me from sleeping well.
- Pain reduces my normal sleep by 1/4 each night.
- Pain reduces my normal sleep by 1/2 each night.
- Pain reduces my normal sleep by 3/4 each night.
- Pain prevents me from sleeping at all.

SECTION 8 - SOCIAL LIFE

- My social life is normal and gives me no pain.
- My social life is normal but increases the degree of pain.
- My social life is unaffected by pain apart from limiting more energetic interests.
- Pain has restricted my social life and I do not go out very often.
- Pain has restricted my social life to my home.
- I have hardly any social life because of the pain.

SECTION 9 - DRIVING / RIDING IN CAR, ETC.

- I get no pain while travelling.
- I get some pain while travelling but none of my usual forms of travel cause it any more.
- I get extra pain while travelling but it does not compel me to seek alternate forms of travel.
- I get extra pain while travelling which compels me to seek alternate forms of travel.
- Pain restricts all forms of travel.
- Pain prevents all forms of transport that does not involve driving.

SECTION 10 - CHANGING DEGREE OF PAIN

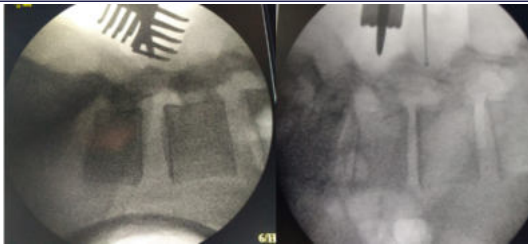
- My pain is rapidly getting better.
- My pain fluctuates but overall is definitely getting better.
- My pain seems to be getting better but improvement is slow at present.
- My pain is neither getting better or worse.
- My pain is gradually worsening.
- My pain is rapidly worsening.

LOW BACK PAIN SCALE

Rate the severity of your Low Back Pain by indicating on the following scale.

Absence I-----I Extreme

C-ARM IMAGES: - No. 14& 15: Marking of disc space, needle showing disc space to be operated



INTRA-OPERATIVE IMAGES: Fig 16&17 Dissection is carried down in the midline through the subcutaneous tissues, fascia to the tips of the spinous processes and Fenestration is done.

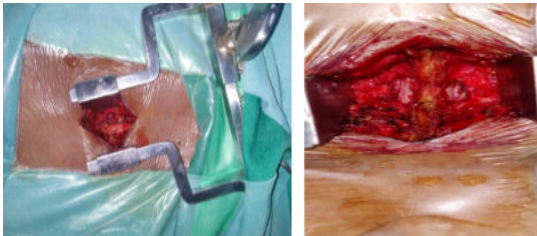


Figure No.18&19: Protruded disc identified and removal of disc material

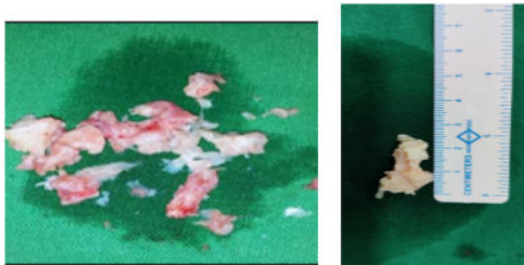


Fig No.-20:-Post-Op Scar



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