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Comparative study of posterior cervical laminectomy versus facet fixation without laminectomy for treatment of cervical spondylotic myelopathy

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Abstract: Background Data: Cervical spondylotic myelopathy is a chronic spinal cord dysfunction in the cervical region due to cervical spondylosis, which is an age-related degenerative disorder of the cervical spine components. It is caused by combination of static and dynamic degenerative factors in the adult population over 50 years. Surgical decompression of the spinal canal is the primary treatment of choice, which can be done directly by eliminating the static factors as in posterior cervical laminectomy or indirectly by eliminating the dynamic factors as in facet fixation leading to regression of the spondylotic features. **Purpose**: is to compare facet fixation operation as a sole management of cervical spondylotic myelopathy versus posterior cervical laminectomy without facet fixation.

Study Design: prospective comparative clinical case study. Patients and Methods: This comparative prospective study involved 40 patients with cervical spondylotic myelopathy, who were admitted and managed in the neurosurgical department of Menoufia University during the period from December 2017 to December 2019. Patients were randomly distributed into two equal groups by simple means of (odd and even numbers) technique. Group (1) included 20 patients who underwent posterior cervical laminectomy without fixation. Group (2) included 20 patients who underwent facet fixation without laminectomy. The patients were followed up for six months in the outpatient clinic of neurosurgery. **Results**: The study included 40 patients, The mean age of group (1) and group 2 were 58.9 ± 7.3 year and 58.7 ± 6.5 years respectively. There was a predominance of male sex (72.5 % of cases), while female represented (27.5%) of both groups. Male: female ratio was (2.64: 1). The mean duration of symptoms was 12 ± 3.6 in group (1) and 7.5 ± 3.7months in group (2). The mean preoperative MJOA score was 8.2 ± 2.1 in group (1) and 9.3 ± 2.7 in group (2). The mean preoperative Nurick's functional grading was 4.2 ± 0.7 in group (1) and 3.95 ± 0.8 in group (2). The mean post-operative MJOA scores score was 12.7 ± 2.8 in group (1) and 14.2 ± 1.9 in group (2). The mean post-operative Nurick's grading was 3 ± 1.1 in group (1) and 2.6 ± 0.7 in group (2). The post-operative neurological recovery rate at the end of the follow up period was excellent in 1patient (5%), good in 10 patients (50%), fair in 6 patients (30%) and 3 (15%) patients had a poor recovery rate In group (1). While the post-operative neurological recovery rate at the end of the follow up period was excellent in 3 patients (15%), good in 11patients (55%), and fair in 5 patients (25%) and 1 (5%) patient had a poor recovery rate In group (2). **Conclusion**: Posterior cervical laminectomy has still its indications. Proper selection of the patients depending on good clinical and radiological investigations can minimize its complications. The older the patient and the absence of preoperative instability yield the best results. Facet fixation provides relief in patients with cervical spondylotic myelopathy. The younger the patient and the presence of preoperative instability necessitate facet fixation and fusion.

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Keywords: Cervical spondylotic myelopathy, posterior cervical laminectomy, facet fixation, cervical fusion.

1. Introduction

Cervical spondylotic myelopathy (CSM) is a spinal cord dysfunction in the neck due to degenerative factors with slow insidious onset presenting with variable symptoms and signs in the adult population. [1]

The repeated injuries to the spinal cord, which result in cervical spondylotic myelopathy, are caused by both static and dynamic mechanical factors. The combination of these factors affects the spinal cord in (CSM) through two mechanisms: direct trauma and ischemia. [2, 3, 4, 5, 6]

The primary treatment of (CSM) is decompression of the spinal cord. The surgery is performed to prevent the progression of symptoms. The goal of surgery is simply to prevent symptoms

from getting any worse. Damage that has occurred in the spinal cord itself can heal, but it is impossible to predict the degree of healing. The prognosis is different in every case. [7]

The posterior surgical procedures including cervical laminectomy with or without fusion and cervical laminoplasty are performed for pathological compression that encompasses three or more vertebral body segments. The exact procedure chosen depends on the location and type of stenosis, the overall alignment of the cervical spine, and many other factors. [8]

Cervical laminectomy has been utilized for the treatment of multilevel cervical spondylosis. It provides adequate decompression of the cervical spinal cord and is easily performed. With the proper selection of patients, posterior cervical laminectomy is effective in offering clinical improvement to patients. Potential risks include dural tear, bleeding, spinal cord injury, epidural scar formation and instability, which result in postoperative pain, infection and even neurologic deterioration. [9]

In 2010, Goel et al presented a new surgical modality using the transarticular facet fixation and fusion operation without laminectomy as a simple, short, safe and sufficient alternative surgery depending upon his philosophy about the role of facet instability, hypermobility and telescoping as the main factor of the vicious cycle of the cervical spondylosis. [10]

2. Material and Methods

This comparative prospective study involved 40 patients with cervical spondylotic myelopathy, who were admitted and managed in the neurosurgical department of Menoufia University in the period from December 2017 to December 2019. Patients were randomly distributed into two equal groups by simple means of (odd and even numbers) technique. Group (1) included 20 patients who underwent posterior cervical laminectomy without fixation. Group (2) included 20 patients who underwent facet fixation without laminectomy. The patients were followed up for six months in the outpatient clinic of neurosurgery. Inclusion criteria involved patients with symptoms and signs of CSM with one or more of the following radiological criteria: Patients whose pathological compression encompasses three or more vertebral body segments, patients in whom thickened ligamentum flavum or hypertrophied facet joints compromises the posterior cervical canal and/or patients with congenital cervical canal stenosis. (AP diameter of less than 10 mm in axial CT scan). the exclusion criteria for selection of cases were:

Patients whose pathologic compression encompasses less than three vertebral body segments and anterior to the spinal cord or patients with previous anterior or posterior cervical surgery, patients with cervical kyphosis more than 5° or Patients with osteoporosis. (T-score of Bone Mineral Density "BMD" at or below -2.5).

All patients were subjected to history taking, full neurological examination and classification by Nurick's functional grading and the scale of the Modified Japanese Orthopedic Association (MJOA).

For posterior cervical laminectomy procedure, operations were done in the prone position. A high-speed burr was used to make a trough in the lamina on both sides just before it joins the facet joint. The laminae with the spinous process were removed as one piece. For facet fixation procedure, operations were done in the prone position with the chest elevated 15° to 30° with cervical traction, which was done prior to induction of anesthesia. We used DalCanto technique, where the entrance point is 2 mm caudal to the midpoint of the lateral mass. Lateral angulation is 20° laterally. Sagittal inclination is 40° caudally. Klekamp technique was used if facet gets cracked or loose screws: where the entrance point: 1 mm medial and 1 to 2 mm caudal to the midpoint of the lateral mass. Lateral angulation is 20° laterally. Sagittal inclination is 40° caudally. A 2 mm high-speed drill was used to penetrate the bone at the entry point. Afterwards, a 2.4 mm tap was used, and 2.7 mm diameter cortical screws were inserted. The usual length was between 12 to 14 mm. Bone grafts from dissected spinous processes and sometimes, iliac bone grafts were placed laterally on both sides of the decorticated facets and small bone chips are added to the facet interspace.

Postoperatively, all patients were placed into a hard neck collar for 6-8 weeks.

3. Results

Age: Group (1): The youngest patient was 43 years old and the oldest was 70 years old with the mean age of 58.9 ± 7.3 years. Group (2): The youngest patient was 41 years old and the oldest was 68 years old with the mean age of 58.7 ± 6.5 years. There was no statistically significant difference regarding the age between the two groups. P value was 0.483.

Sex: There was a predominance of male sex (72.5 % of cases), while female represented (27.5%) of cases. Male: female ratio was (2.64: 1). Group (1): The patients were 13 (65%) males and 7 (35%) females Group (2): The patients were 16 (80%) males and 4 (20%) females. There was no statistically significant difference regarding gender between the two groups. P value was 0.106.

Table (1). Demographic, clinical and radiological data of Group (1):

No	Age	Sex	Duration of symptoms	Pre-op Nurick	Pre-op MJOA	Post-op Nurick	Post-op MJOA	NRR %	NRR
1	52	M	>1Year	4	8	3	12	40	Fair
2	65	F	6months-1year	5	6	4	12	50	Good
3	70	M	>1Year	4	8	2	15	70	Good
4	53	F	6months-1year	4	9	3	12	33	Fair
5	43	M	<6months	3	12	2	15	50	Good
6	60	M	>1Year	4	10	2	15	63	Good
7	55	M	6months-1year	3	12	2	15	50	Good
8	66	F	>1Year	4	8	4	11	30	Fair
9	45	M	6months-1year	4	8	2	15	70	Good
10	67	M	>1Year	5	7	2	15	73	Good
11	57	M	6months-1year	4	9	3	13	44	Fair
12	63	M	>1Year	5	5	5	7	15	Poor
13	64	F	>1Year	5	6	5	7	8	Poor
14	48	M	6months-1year	3	12	3	14	33	Fair
15	62	F	>1Year	5	5	5	7	15	Poor
16	59	M	6months-1year	4	8	4	11	30	Fair
17	63	M	>1Year	5	6	2	15	75	Excellent
18	62	F	>1Year	4	9	2	15	67	Good
19	60	M	6months-1year	4	8	2	15	70	Good
20	64	F	>1Year	4	8	3	13	50	Good
Mean	58.9		12	4.15	8.2	3	12.7	46.8	
SD	7.3		3.6	0.7	2.1	1.1	2.8	20.4	

Table (2). Demographic, clinical and radiological data of Group (2):

No	Age	Sex	Duration of symptoms	Pre-op Nurick	Pre-op MJOA	Post-op Nurick	Post-op MJOA	NRR %	NRR
1	65	M	>1year	5	7	2	15	73	Good
2	62	M	<6month	3	12	3	14	33	Fair
3	68	M	6month-1year	4	10	2	15	63	Good
4	49	M	6month-1year	5	6	2	15	75	Excellent
5	59	M	<6month	3	12	3	14	33	Fair
6	58	M	6month-1year	4	9	3	14	56	Good
7	62	F	<6month	3	13	2	16	60	Good
8	63	M	6month-1year	4	9	4	9	0	Poor
9	58	F	<6month	5	5	2	15	77	Excellent
10	67	M	6month-1year	4	8	4	11	30	Fair
11	60	M	6month-1year	5	6	2	15	75	Excellent
12	50	M	<6month	3	13	2	16	60	Good
13	50	M	6month-1year	3	12	2	15	50	Good
14	62	F	>1year	4	11	3	14	43	Fair
15	63	M	6month-1year	3	12	2	16	67	Good
16	59	M	6month-1year	4	8	4	11	30	Fair
17	57	M	6month-1year	5	7	2	15	73	Good
18	41	M	<6month	5	5	3	12	54	Good
19	59	F	6month-1year	4	9	2	15	67	Good
20	62	M	<6month	3	12	2	16	67	Good
Mean	58.7		7.5	3.95	9.3	2.55	14.15	54.3	
SD	6.5		3.7	0.8	2.7	0.7	1.9	19.9	

Table (3). Preoperative clinical presentations

Pre-operative presentations		Group (1)		Group (2)	
		No	%	No	%
Symptoms	Heaviness in (LEs) and stiff gait	18	90	15	75
	Neck Pain	14	70	17	85
	Sphincter disturbances	12	60	7	35
	Limitation of neck movements	10	50	4	20
	Brachialgia	14	70	17	85
	Hand numbness	5	25	4	20
	Weakness of (UEs)	4	20	3	15
signs	Hyperreflexia	20	100	18	90
	Weakness in UEs	7	35	3	15
	Weakness in LEs	18	90	15	75
	Weakness in (UEs) & (LEs)	7	35	3	15
	Gait Disturbances	18	90	15	75
	Positive Babinski sign	11	55	5	25
	Ankle Clonus	9	45	4	20
	Spasticity	11	55	5	25
Duration	Less than 6 months	1	5	7	35
	From 6 month to 1 year	8	40	11	55
	> One year	11	55	2	10
P value of symptoms		0.142 NS			

Preoperative clinical presentations: there was statistically non-significant difference regarding the pre-operative clinical symptoms in both groups, as P value was 0.142.

The pre-operative Nurick's functional grades: there was no statistically significant difference in both groups. The P-value is 0.086.

The pre-operative MJOA score: there was no statistically significant difference in both groups. The P-value was 0.089. Group (1): the minimum score was 5, maximum score was 12 and the mean was 8.2 ± 2.07. Group (2): the minimum score was 5, maximum score was 13 and the mean was 9.3 ± 1.91.

Table (4). Operative related complications

Symptoms	Group (1)		Group (2)	
	No	%	No	%
C5 root pain	3	15	0	0
Facet crack	0	0	5	25
Superficial wound infection	2	10	1	5
Instability	3	15	0	0
Kyphosis	3	15	0	0

Operative related complications in this study: there were no serious complications such as neurovascular injuries, CSF leak, or deep infection necessitating screws removal. In group (1), Three patients (15%) had C5 radicular pain and were improved on medical treatment. Three patients (15%) had segmental instability in a single level; they refused further surgery of fixation as it did not affect the outcome. Three patients (15%) developed kyphosis < 10° and were prepared for fixation. In group (2). Five patients (25%) had cracked facets in a single level at one side and were reinserted by Klekamp technique in non-cracked part. No screws pull up or break.

The postoperative clinical results: there was statistically significant difference as P value was <0.05. Group 2 had better "improved" and less "worsened" post-operative clinical results.

Table (5). The postoperative clinical results

Post-operative clinical results	Improved				No change				Worsened			
	Group 1		Group 2		Group 1		Group 2		Group 1		Group 2	
	No	%	No	%	No	%	No	%	No	%	No	%
Heaviness in (LEs) and stiff gait	13/18	72	13/15	87	4	22	2	13.3	1	5.6	0	0
Neck Pain	4/8	50	10/12	84	2	25	1	8	2	25	1	8
Sphincter disturbances	8/12	67	4/7	57.2	3	25	2	28.6	1	8.3	1	14.3
Limitation of neck movements	2/10	20	2/4	50	6	60	1	25	2	20	1	25
Brachialgia	1/4	25	6/6	100	1	25	0	0	2	50	0	0
Weakness of (UEs) and hand grip	2/4	50	2/3	66.7	2	50	1	33.3	0	0	0	0
P-value	0.001				0.001				0.003			

The post-operative Nurick's grades: there was statistically significant difference between the two groups. Group (2) had better post-operative Nurick's grades. P-value was 0.012.

The relation between the pre-operative and post-operative Nurick's grades: group (1), there was no significant relation between them. The P-Value was 0.759. The Nurick's score preoperatively, did not influence the final postoperative Nurick's score. 15 patients (75%) showed upgrading in Nurick's grade after surgery by a mean of 6 months. 3 patients (15%) demonstrated stable but unimproved myelopathy 2(10%) patients downgraded. In Group (2): there was no significant relation between the pre-operative and post-operative Nurick's grades. The P-Value was 0.054. The Nurick's score preoperatively, did not influence the final postoperative Nurick's score. 15 patients (75%) showed upgrading in Nurick's grade after surgery by a mean of 6 months. 5 patient (25%) demonstrated stable but unimproved myelopathy.

The Post-operative MJOA scores: in Group (1), the pre-operative MJOA score ranged from (5– 12) and the mean was 8.2. After 3 months of surgery, the MJOA score improved where the mean became 10.5/17 and the range was (6 – 14). After 6 months of surgery, the mean became 12.7 /17 and the score range was (7 - 16). In Group (2), the pre-operative MJOA score ranged from (5– 13) and the mean was 9.3. After 3 months of surgery, the MJOA score improved where the mean became 11.8/17 and the range was (8 - 14). After 6 months of surgery, the mean became 14.15/17 and the score, range was (9 - 16). There was statistically significant difference regarding the post-operative MJOA score at 6 months in both groups. The P-value of post-operative MJOA score at 6 months was <0.001. Group (2) had better post-operative MJOA scores.

The post-operative NRR: there was statistically significant difference regarding the post-operative NRR percentages at 6 months in both groups. P value was 0.001. Group (2) had better post-operative excellent and good NRR. In Group (1), the post-operative neurological recovery rate at the end of the follow up period was excellent in 1patient (5%), good in 10 patients (50%), fair in 6 patients (30%) and 3 (15%) patients had a poor recovery rate. In Group (2), the post-operative neurological recovery rate at the end of the follow up period was excellent in 3 patients (15%), good in 11patients (55%), and fair in 5 patients (25%) and 1 (5%) patient had a poor recovery rate. Both excellent and good recovery rates were considered satisfactory while fair or poor recovery rates are considered unsatisfactory.

According to the correlation of age and the neurological recovery rate at the end of follow up in both groups in this study, there was no significant association between age and NRR in both groups. P value was 0.121 in group (1) and 0.243 in group (2).

According to the correlation of duration of symptoms and the neurological recovery rate at the end of follow up in both groups in this study, there was no significant association between duration of symptoms and NRR in both groups. P value was 0.447in group (1) and 0.745 in group (2).

At the end of the follow up period, there was statistically significant difference regarding the post-operative radiological findings in both groups as P value < 0.001. In Group (1), pre-operatively 6 (30%) patients had loss of lordosis, post-operatively 14 (70%) patients had. Pre-operatively 19 (95%) patients had disc osteophyte complexes, post-operatively 18 had. Pre-operatively 2 (10%) patients had OPLL, post-operatively there was no change. Pre-operatively 5 (50%) patients had instability, post-operatively 7 (70%) patients had instability. Pre-operatively 16 (100%) patients had cord signal (myelomalacia), post-operatively 14 (70%) had. In Group (2), pre-operatively 7 (35%) patients had loss of lordosis, post-operatively 2 (10) had. Pre-operatively 17 (85%) patients had disc osteophyte complexes, post-operatively 3 (15%) had. 1 (5%) patients had OPLL, post-operatively there was no change. Pre-operatively 14 (70%) patients had ligamentum flavum hypertrophy, post-operatively no patients had. Pre-operatively 6 (50%) patients had instability, post-operatively no patients had instability. Pre-operatively

14 (100%) patients had cord signal (myelomalacia), post-operatively 11 had.

4. Discussions

Cervical spondylotic myelopathy is universally believed to be caused by both dynamic and static factors. All efforts have been directed toward elimination of the static factors like cervical intervertebral discs and disc-osteophyte complexes, hypertrophied ligaments, and/or OPLL. Even the added fixation and eventually fusion is just complementary to the resection procedures to prevent the expected postoperative instability. [1] Goel et al directed his efforts to fix the dynamic factors only by a short, simple, safe and sufficient procedure of only facet fixation proposing that facet instability is the main driving player of spondylotic process. [10]

In the current study: Group (1) included 20 patients who underwent posterior cervical laminectomy without fixation. Group (2) included 20 patients who underwent facet fixation without laminectomy. The patients were followed up for six months in the outpatient clinic of neurosurgery.

As regard the age distribution in the current study, in group (1), the youngest patient was 43 years old and the oldest was 70 years old with the mean age of 58.9 ± 7.3 years. This was close to Neilakuo et al, with age varying from 46 to 80 (mean-57) years. [11] It is different from Woernle et al, where the mean age of the patients was 67 ± 13 years old. [12]

While in group (2), the youngest patient was 41 years old and the oldest was 68 years old with the mean age of 58.7 ± 6.5 years. Goel et al had similar age results where the ages ranged from 40 to 73 years (mean 56 years). [13, 14] While in another study Goel et al, reported that the average was 40.6 years. There was no statistically significant difference regarding the age between the two groups. [15]

As regard the sex distribution in the current study, there was a predominance of male sex (72.5 % of cases), while female represented (27.5%) of cases. Male: female ratio was (2.6: 1). In group (1), the patients were 13 (65%) males and 7 (35%) females. It was close to the sex distribution in Neilakuo et al, Woernle et al and Hakan et al studies. [11, 12, 16] While in group (2), there were 16 (80%) males and 4 (20%) females that was close to Goel et al studies. [17, 15, 14] There was no statistically significant difference regarding gender between the two groups, as P value was 0.106.

According to the correlation of age and the neurological recovery rate (NRR) at the end of follow up in both groups, there was no significant association between age and NRR in both groups, as P value was 0.121 in group (1) and 0.243 in group (2). The difference was statistically non-significant where P value is > 0.05. Hakan et al, Kazuya et al and Goel et al concluded similar results in their studies that the patient's age at presentation was not an important variable or prognostic factor influencing the surgical outcome. [16, 18, 14, 19]

In the current study, the common pre-operative presentations of patients of group (1) were heaviness in lower limbs and stiffness of gait (90 %), neck pain and brachialgia (70 %) and sphincteric disturbances (60 %). Ryken et al and Kaptain et al had close results in their corresponding studies. [20, 29] The common pre-operative symptoms of patients of group (2) were heaviness in lower limbs and stiffness of gait (75 %), neck pain and brachialgia (85%) while sphincteric disturbances were in (15 %) of patients. These results were close to Goel et al. [14, 19]

There was statistically non-significant difference regarding the pre-operative clinical symptoms in both groups, as P value was 0.142.

According to the correlation of the duration of symptoms and the neurological recovery rate at the end of follow up period in this study, there was no significant association between duration of symptoms and NRR in both groups. In group (1): P value was 0.447. The difference was statistically non-significant where P value is > 0.05. This met with Ryken et al, and Hakan et al who reported that there was no significant relation between the duration of symptoms preoperatively, and the outcome. [20, 16] In group (2): P value was 0.745. The difference was statistically non-significant where P value is > 0.05. The duration of symptoms was statistically non-significant in relation to the outcome in the study of Goel et al 2019). [14, 19]

Regarding to the pre-operative radiological findings, there was no statistically significant difference regarding the pre-operative radiological findings in both groups. The common findings were Loss of lordosis (straightening), disc osteophyte complex, OPLL, ligamentum flavum hypertrophy, Instability, cord signal (myelomalacia) which met and consistent with other studies among patients with CSM in the literature. [21]

In contrast, there was statistically significant difference regarding the post-operative radiological findings in both groups in the current study. In group (1): Loss of cervical lordosis incidence, changed from 50 % to 70 % of patients post-operatively. This was close to Hakan et al. [16] Disc osteophyte complexes and OPLL showed no difference in the postoperative images. This was close to Neilakuo et al. [11] Instability involved 2 more patients in addition to preoperative 5 patients. This was close to Kaminsky et al. [22] Cord signal (myelomalacia); 2 of 16 patients showed improvement. This was close to Woernle et al. [12] In group (2): There was significant reversal of loss of lordosis, regression of disc osteophyte

complexes and ligamentum flavum hypertrophy. Post-operatively, there was no radiological change in the OPLL. Post-operatively, no patients had instability. Cord signal (myelomalacia), 3 of 14 patients showed improvement.

These results were close to Goel et al studies regarding this technique. Goel et al published that postoperative imaging showed nearly complete vanishing of the disc protrusions if the posterior longitudinal ligament was essentially intact in all 4 cases with restoration of the cervical cord girth and distraction-fixation arthrodesis of the spinal segment. [23]

MRI and CT scan at 6 months after surgery showed the regression of the disc and/or disc-osteophyte complexes in at least one or more spinal level in 39 cases of 64 patients. [14, 19]

Our results were close to Ajiboye et al who concluded that patients with cervical spondylotic myelopathy that underwent a posterior surgical fusion were associated with a regression in disc-osteophyte complex size compared to non-fusion posterior procedures. This was related to the loss of mobility of the cervical spine after the operation as governed by the Heuter-Volkmann's principle and Wolff's law. [24]

In addition, our results were close to Adedayo et al who reported regression of anterior disc-osteophyte complexes after posterior cervical fusion, complementary to laminectomy for cervical spondylotic myelopathy in a group of 24 patients who showed variable degrees of disc osteophytes reversal and resorption with average 40% reduction in size by 3 and 6months MRI cervical spine. The findings of this study suggest that regression of the anterior-disc osteophyte complex also occurs following laminectomy and fusion, and likely provides another mechanism of spinal cord decompression. [25]

As regard the relation between the pre-operative and post-operative Nurick's grades in the current study: In group (1), there was no statistically significant relation between the pre-operative and post-operative Nurick's grades. The P-Value was 0.759. The difference was statistically non-significant at $P > 0.05$. The preoperative Nurick's score did not influence the final postoperative Nurick's score. 14 patients (70%) showed upgrading in Nurick's grade after surgery by a mean of 6 months. 3 patients (15%) demonstrated stable but unimproved myelopathy, and 3 (15%) patients downgraded. These results matched with Ryken et al, as there was no significant difference in the functional status variation. [20] In group (2), there was no significant relation between the pre-operative and post-operative Nurick's grades, as P-Value was 0.054. The difference was statistically non-significant at $P > 0.05$. The Nurick's score preoperatively, did not influence the final postoperative Nurick's score. 15 patients (75%) showed upgrading in Nurick's grade after surgery by a mean of 6 months. 5 patient (25%) demonstrated stable but unimproved myelopathy. These were close to Goel et al. [14, 19]

There was statistically significant difference regarding the post-operative Nurick's functional grades of both groups. The P-value of post-operative grades was 0.012. Group (2) had better post-operative Nurick's grades.

In the current study: the pre-operative MJOA score and the post-operative score in the follow up period: In Group (1): The pre-operative MJOA score ranged from (5– 12) and the mean was 8.2. After 6 months of surgery, the mean became 12.7 /17 and the score range was (7 - 16). Neilakuo et al reported similar results in their study that MJOA scores improved to mean value 11 from pre-operative mean value of 7.19. [26] In Group (2): The pre-operative MJOA score ranged from (5 to 13) and the mean was 9.3. After 6 months of surgery, the mean became 14.25/17 and the score, range was (9 to 16). These were close to Goel et al, who reported that 64 patients were ranging from (7 to 12) preoperatively, After 6 months of surgery, 52 patients ranged from (13 to 17). [14] There was statistically significant difference regarding the post-operative MJOA score at 6 months in both groups, as P-value of post-operative MJOA score at 6 months was 0.001. Group (2) had better post-operative MJOA scores.

The operative related complications in this study: there were no serious complications such as neurovascular injuries, CSF leak, or deep infections were documented in both groups.

In group (1): Three patients (15%) had C5 radicular pain and were improved on medical treatment. Three patients (15%) had segmental instability in a single level; they refused further surgery of fixation as it did not affect the outcome. Three patients (15%) developed kyphosis < 10° and were prepared for fixation. Geest et al identified a rate of 9% comprising postoperative C5 radiculopathy and superficial wound infection that is, consistent with the literature. These results strengthen the role of cervical laminectomy as a safe procedure with low morbidity. [26] The postoperative instability and kyphosis match with the reported results of Lad et al & Du et al. [27, 28] Kaptain et al, reported that postoperative Kyphosis may occur in up to 21% of patients who have undergone laminectomy for CSM. [29]

In group (2): One patient (5%) had superficial wound infection. Antibiotics and daily dressing overcame this. Five patients (25%) had cracked facets in a single level at one side and the screws were reinserted by Klekamp technique in non-cracked part.

No screws pull up or break. There were no serious complications, which have met with the results of Goel et al. [17, 13, 30, 14, 19]

In regards to the post-operative clinical results; in group (1): Neck pain was improved in (50 %), worsened in (25 %) not changed in (25%) of patients. Heaviness in (LEs) and stiff gait, were improved in (72 %), worsened in (5.6 %), and not changed in (22%) of patients. Sphincter disturbances were improved in (67 %), worsened in (8.3 %) and not changed in (25%) of patients. These results were close to the results of Ryken et al and Lad et al. [20, 27]

In group (2): There was immediate postoperative improvement of brachialgia, hand numbness and weakness in all the symptomatic patients with these presentations. Neck pain was improved in (84 %), worsened in (8 %) not changed in (8%) of patients. Heaviness in (LEs) and stiff gait, were improved in (87 %), worsened in (5.6 %) not changed in (22%) of patients. Sphincter disturbances was improved in (57.2 %), worsened in (8.3 %) not changed in (28.6%) of patients. These results have met with the results of Goel et al. [17, 13, 31, 14, 19]

There were statistically significant differences regarding the postoperative clinical results in both groups. Group 2 had better "improved" and less "worsened" post-operative clinical results where P value was 0.001 and 0.003 respectively.

In the current study of Group (1), the post-operative neurological recovery rate at the end of the follow up period was excellent in 1 patients (5%), good in 10 patients (50%), fair in 6 patients (30%) and 3 (15%) patients had a poor recovery rate. These results are close to the results of Ryken et al. [20]

In the current study of Group (2), the post-operative neurological recovery rate at the end of the follow up period was excellent in 3 patients (15%), good in 11 patients (55%), and fair in 5 patients (25%) and 1 patient (5%) had a poor recovery rate. which is close to Goel et al. [14, 19, 23]

Both excellent and good recovery rates are considered satisfactory while fair or poor recovery rates are considered unsatisfactory.

5. Conclusion

Posterior cervical laminectomy has still its indications. Proper selection of the patients depending on good clinical and radiological investigations can minimize its complications. The older the patient and the absence of preoperative instability yield the best results. Facet fixation provides relief in patients with cervical spondylotic myelopathy. The younger the patient and the presence of preoperative instability necessitate facet fixation and fusion.

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