International Journal of
Science Inventions Today
www.ijsit.com
ISSN 2319-5436
Research Article

COMPARING SURGICAL OUTCOME BETWEEN POSTERIOR APPROACH AND ANTERIOR APPROACH FOR OSSIFICATION OF POSTERIOR LONGITUDINAL LIGAMENT (OPLL)

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ABSTRACT

It is a hyperostotic condition which results in ectopic ossification in the posterior longitudinal ligament in the spine and can lead to myelopathy. It mostly effects people between age 50-70 and is more common in Asian countries. To compare the efficiency of anterior and posterior surgical treatment, we retrospectively studied both approaches in 100 patients, which were randomly selected with ossified posterior longitudinal ligament, who went through surgical treatment within the past five years with two different techniques (posterior single door laminoplasty and anterior cervical fusion); we found pre and post-operative JOA score, VAS score, spinal canal stenosis, complications, bleeding etc. Results On basis of our research the mean preoperative JOA score in posterior approach group was 7.35 which significantly rose to 12.90 and in the anterior group preoperative JOA score was 8.40 which significantly rose to 14, In the anterior approach group the mean preoperative VAS score was 2.17 which lowered to 1.05 after surgery and in the posterior approach group preoperative VAS score was 1.90 which lowered to 1.04 after surgery. Preoperative spinal canal stenosis was 8.25mm in anterior group and 7.33mm in posterior group, which significantly rose to 14.12mm in anterior group and 12.98mm in posterior group after surgery. Mean bleeding was 188.23cc in the anterior group patients and 276,7cc in the posterior group patients. This study reveals that anterior approach was alternative to posterior approach for single level OPLL and posterior approach was alternative to anterior approach for multilevel OPLL.

Keywords: VAS (visual analogue score), ACF (anterior cervical and fusion), SDL (single door laminoplasty).

INTRODUCTION

Ossification of posterior longitudinal ligament is a progressive disease, which thickens and ossifies posterior ligamentous tissue in the cervical spine and causes ectopic bone formation in posterior longitudinal ligaments. OPLL reduces range of motion in limbs and OPLL (ossification of posterior longitudinal ligament) was reported in 1838 for the first time. Years later an OPLL autopsy was performed in 1969 in Tsukimoto, Japan. A 3mm ossified mass was found in C3-C4 in a 47 years old patient. [1] Ossification of posterior longitudinal ligament cases were mostly found in Asian countries so it was called the Asian disease. [2] OPLL cases were rarely found in Europe and the USA. Cases of DISH (diffuse idiopathic skeletal hyperostosis) were very well known in the USA and Europe, about half of patients with DISH had Ossification of posterior longitudinal ligament, the disease has come to be recognized as a subtype of DISH(defused idiopathic skeletal hypertrophy) [3,4] and increase the risk of spinal cord injury following a traumatic event[1]. it occurs in most often in obese men and is the main cause of myelopathy and spinal cord stenosis in the cervical spine. [5,6,7,8]. It mostly effects people between ages 50-70 years but also can occasionally happen in children, though this is very rare. The first IDC (intervertebral disc calcification) case was reported in 1924 in Baron. The most common location for OPLL is the C4-C6 vertebrae and is rarely found at the C1-C2 level and it effects 92% in the cervical spine, 15% in the thoracic spine and 4% in other spinal levels.[9,10,11] Dural ossification can be seen in almost 10% of cases with OPLL.[1] it has been estimated that up to 25% of patients presenting with cervical myelopathy have features of OPLL.[12] T-OPLL: 15% of OPLL occurs in the thoracic spine which may lead to severe myelopathy, dyskinesia, sensory disturbances, fecal & urinary incontinence and even paralysis, T-OPLL is slowly progressive and symptoms are typically seen in advanced stages, OPLL is well classified and diagnosed with 2-dementional and 3-dementional CT scan. According to the Japanese ministry of Health OPLL have 4 types (segmental type, continuous type, mixed type and circumscribe type). T1 segment is most frequently effected in both men and women followed by T1-T2 and T3-T4, severe OPLL in thoracic spine occurs more in women than men(20% vs. 4.5%) and thoracolumbar ossified lesions are most common in women. Ossified lesions were frequently seen at the intervertebral and vertebral levels around the cervical-thoracic and thoracolumbar junctions in men with severe OPLL, whereas OPLL was more diffusely distributed in the thoracic spine in women with severe OPLL. [13,14] T-OPLL has a much higher disability rate than C-OPLL (cervical ossification of posterior longitudinal ligament).[14]Posterior surgery is performed in more than 80% of thoracic OPLL cases .[11]A study has identified five new potential pathogenic loci for T-OPLL: rs201153092 and rs13051496 in the COL6A1 gene, rs199772854, rs76999397 and rs189013166 in the IL17RC gene which may help clarify molecular etiology of T-OPLL[14]. Symptoms of OPLL include sensory and motor dysfunction of both upper and lower extremities, abnormal reflexes, bladder dysfunction, cervical pain or discomfort, and numbness of the upper extremities.[15] However, 5% of patients were reported free of symptoms. Purpose of our study was to find out deference between anterior and posterior approach, and determine a better approach site by looking at each group's JOA score, VAS, spinal canal stenosis, bleeding quantity, operation time and post-operative complications.

MATERIAL AND METHODS

We have selected and analyzed 100 patients randomly with ossification of posterior longitudinal ligaments who underwent trough surgical treatment within the past five years at orthopedic department of second affiliated hospital of China medical university. We divided the patients into 2 groups according to their surgical approach side. One group received anterior cervical decompression and fusion surgery (cervical decompression and fusion is a surgical procedure in which the damaged intervertebral disc is removed at the spinal levels, being decompressed, then the evacuated disc space is prepared for a bone graft, the grafted segments are fixed with the plates and screws to stabilize and spine while the adjacent vertebrae fused together over a period of months and this procedure is preferred for single or double level OPLL) and the other group received posterior single door laminoplasty (it's a surgical procedure for spinal canal stenosis due to OPLL. By releasing pressure on the spinal cord, the procedure involves cutting the lamina of both sides of the effective vertebrae, cutting through one side and merely cutting the groove other, then swinging the freed flap of bone, thus releases the pressure, it creates a new arch in lamina, this allows the roof of canal to open on the contralateral side, mostly performed on C3-C7, the bone flap s then propped open using small wedges or piece of bone such that the enlarged spinal canal will remain in place). This procedure is preferred by surgeon for multilevel OPLL patients because it has the advantage of receiving treatment without touching the pathology and can address a multilevel with a single incision, during this study we found JOA score both preoperative and post-operative , preoperative VAS score, post-operative VAS score, pre and post-operative anteroposterior diameter of the spinal canal, pre and post-operative posterior diameter of the spinal canal, bleeding, time of operation in both groups and postoperative complications, beside that we listed gender, age, effected(ossified) site in spine then we compared all mentioned factors between the both surgical approach groups. After data collection we found average mean for whole data and then we got the P-value between both groups which was the most essential part of our study.

Statistical Analysis:

For statistical analysis we used statistical package for the social sciences (SPSS) 20.0 program. We applied non pared T-test to compare the difference between the two groups, we found significant P-value in bleeding quantity which is 0.036.

RESULT

On the basis of our research the mean preoperative JOA score in posterior approach group was 7.35 which significantly rose to 12.90mm after surgery and in the anterior approach group preoperative JOA (Japanese orthopedic association) score was 8.40 which significantly rose to 14 after surgery. In the anterior approach group the mean preoperative VAS score was 2.17 which lowered to 1.05 after surgery and in the posterior approach group preoperative VAS score was 1.90 which lowered to 1.04 after surgery. Preoperative spinal canal stenosis was 8.25mm in the anterior group and 7.33mm in the posterior group, which significantly rose to 14.12 and 12.98 after surgery. Mean bleeding was 188.23cc in the anterior group patients and 276,7cc

in the posterior group patients and 300 cc in combined patients. Mean operation time was 2h 45.4mins in anterior group, 2h 44.3mins in posterior group and 5h1min in combined group [table2]. Of the 100 patients, 73 were male and 27 were female, the mean age was 55.5 (33-78) in the posterior approach group and 53.5 (34-73) in the anterior approach group and 57.3(51-67) in the overall combined approach group, there was significant age difference in mentioned groups. Of the 73 male patients 20 went under anterior approach surgery, 53 went through posterior approach and 3 patients went through a combined approach. Of the 27 female patients 10 went through anterior approach surgery and 17 went through posterior approach, According to the OPLL type, most of the patients had segmental OPLL (52) which accounts for 52 % of our research, 5% (5) patients had continuous OPLL, 34% (34)patients had mixed OPLL and 9% (9) patients had localized OPLL [table1] There were no significant difference in age, sex, operation time, JOA score, VAS score, spinal canal measurement and complications in both group. But there was significant different in bleeding quantity, which was significantly lower in anterior approach group than posterior approach group (181.5 ± 129.5 vs 261.4 ± 177.6 p<0.036) and surgical complication rate was higher in posterior approach (0% vs 7% P= 0.154). Posterior approach was more frequently chosen by surgeons. The mean duration of VAS and JOA score was not significant different in both group's outcome (VAS: 1.3 ± 1.5 vs 1.3 ± 1.5 P=0.971, JOA 13.1 ± 1.7 vs 12.7 ± 1.3 P=0.251). Both groups had no significant difference in other research factors.[table 3]

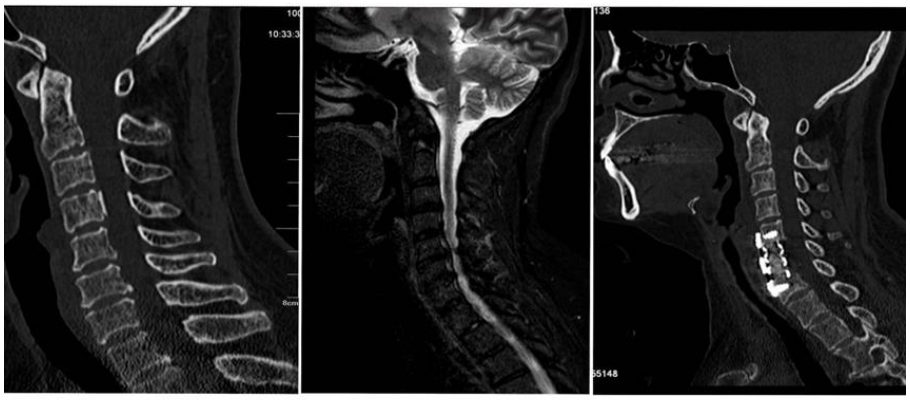

Figure 1: Shows example of anterior approach, images from left to right, 1: preoperative CT scan, 2: preoperative MRI, 3: post-operative CT.

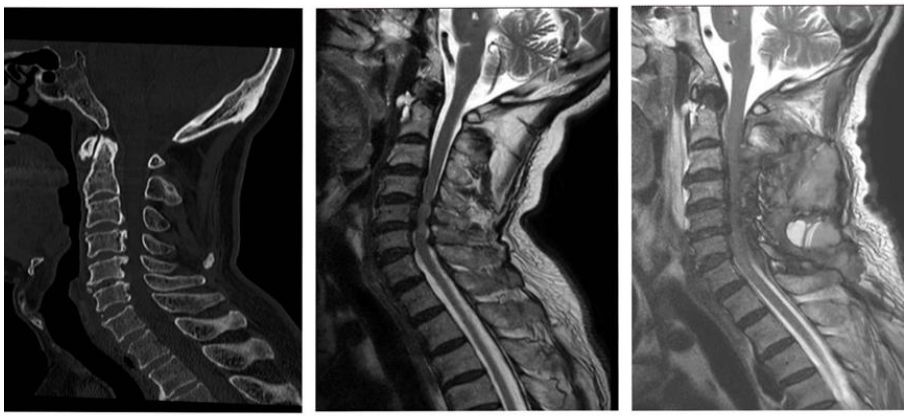

Figure 2: Shows example of posterior approach, images from left to right, 1: preoperative CT, 2: preoperative MRI, 3: post-operative MRI.

Characteristics	Anterior group	Posterior group	Combined group
Patients 100	27	70	**3**
Mean age (years)	53.5 (34-73)	55.5 (33–78)	57.3(51-67)
Gender			
Male (73)	20	53	1
Female (27)	10	17	2
Type of OPLL			
Segmental	14	37	1
Continuous	0	5	
Mixed	7	25	2
Localized	4	5	

Table 1: This table shows preoperative and postoperative JOA, VAS and spinal canal length, also bleeding and operation time is listed.

Parameter	Group ant app (n = 27)	Group post app (n = 70)	Ant-post approach Group (n = 1)
Preoperative JOA score	8.40	7.35	10
Post-operative JOA score	14	12.90	13
Preoperative VAS	2.22	2.33	2
Post-operative VAS	1.26	1.25	1.33
Preope spinal canal length	8.30	7.33	7.78
Post ope spinal canal length	14.12	12.98	12.88
Bleeding	189.28cc	258.9cc	266cc
Operation time	2h45.4mins	2h50mins	3h59mins

Table 2: This figure shows posterior approach is more common for OPLL treatment, and male are more prone to OPLL then women.

Characteristics	Anterior	Posterior	Standardize diff.	p-value
N	27	70		
AGE	56.4 ± 9.3	59.6 ± 9.8	0.3 (-0.1, 0.8)	
0.141				
SEX			0.2 (-0.2, 0.7)	0.290
0	18 (66.7%)	54 (77.1%)		
1	9 (33.3%)	16 (22.9%)		
Operation TIME	161.4 ± 41.6	159.0 ± 53.5	0.1 (-0.4, 0.5)	0.831
JOA	10.8 ± 2.5	10.3 ± 1.7	0.2 (-0.2, 0.7)	0.268
JOA AFTER	13.1 ± 1.7	12.7 ± 1.3	0.2 (-0.2, 0.7)	0.251
VAS	2.3 ± 2.5	2.2 ± 2.4	0.1 (-0.4, 0.5)	0.788
VAS AFTER	1.3 ± 1.5	1.3 ± 1.5	0.0 (-0.4, 0.5)	0.971
PREOPERATIVE	8.4 ± 1.8	8.2 ± 2.1	0.1 (-0.3, 0.5)	0.669
SPINAL.CANAL				
POSTOPERATIVE	13.1 ± 2.1	12.7 ± 1.7	0.2 (-0.2, 0.7)	0.320
SPINAL CANAL				
BLEEDING	181.5 ± 129.5	261.4 ± 177.6	0.5 (0.1, 1.0)	0.036
COMPLICATION			0.4 (-0.1, 0.8)	0.154
0	27 (100.0%)	65 (92.9%)		
1	0 (0.0%)	5 (7.1%)		

Table 3: Shows the P value and standard difference.

DISCUSSION

This study shows that men are more commonly affected by OPLL than women. The surgeons chose posterior approach more often for segmental, continuous and mix type OPLL and anterior approach for localized, segmental and mixed types of OPLL. This means the posterior approach is the most common choice among surgeons for OPLL (ossification of posterior longitudinal ligament) due to often selection of anterior approach which comes with a more favorable post operation outcome with few post-operative complications. And the combined approach or anterior-posterior approach is less common due to a high complication rate, more bleeding, and a longer operation time. Previous studies showed mean age 55.8 years old for men patients but in our research it's 53.5 years old. And they found continuous and mixed OPLL had worse surgical outcome and higher VAS/JOA score but in our study we didn't find any significant difference in these OPLL types [16].Previous literature investigations found that the anterior approach had lower complications than the posterior approach [17,18] which we found similar in our research. Other studies such as article (Comparison of anterior corpectomy and fusion versus laminoplasty for the treatment of cervical ossification of posterior longitudinal ligament: a meta-analysis, Neurosurgery Focus, 2016) [19,20] found that ACF (anterior corpectomy and fusion) group had a better impact on OPLL in general than laminoplasty and found that ACF showed higher complications than the posterior approach group which is opposite in our study, we found 5 complications in the above 100 patients which were all approached posteriorly, We also found that ACF group had longer operation time and higher blood lost which is again, opposite in our research, we found the posterior approach had on average longer operation time and bleeding than the ACF group. Both groups have shown positive response to the surgical approach, but posterior approach has a significant higher bleeding rate with a better recovery rate but, in some cases there were complications such as 4 nerve injuries and 1 fat liquefaction. In the above 100 patients only 5 posterior approach patients had complications, 4 nerve injuries and 1 fat liquefaction. In this study no complication has been found in posterior approach group, but many articles have revealed complications in the anterior approach OPLL treatment.

CONCLUSION

In early cases OPLL patients might get better with conservative treatment but in advance stage they may need surgical management. According to our study we found that compared to posterior approach, anterior approach group had no post-operative complications, lower operation time, and significant difference in bleeding. Anterior approach also had better scores in post-operative VAS, postoperative JOA score and postoperative spinal canal extension. According to our study multiple level OPLL patients received better results by posterior approach and single level cervical OPLL patients received better result with anterior approach. This study reveals that anterior approach was alternative to posterior approach for single level OPLL and posterior approach was alternative to anterior approach for multilevel OPLL.

Conflict of Interest:

The authors declare that they have no conflict of interest.

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