EVALUATION OF CERVICAL ENDPLATE CHANGES FOLLOWING ANTERIOR CERVICAL DISCECTOMY AND FUSION USING POLYETHERETHERKETONE CAGES BY COMPUTED TOMOGRAPHY

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Introduction

An anterior cervical discectomy and fusion (ACDF) is a surgical procedure for treating symptomatic cervical disc disorders (CDDs). It involves neural tissue decompression, removing disc material osteophytes and ossified ligaments, and stabilizing decompressed segments with cages. ACDF is indicated for disorders such as chronic cervical disc herniation, cervical spondylosis, cervical stenosis and cervical disc degeneration with radiculopathy or myelopathy. Different types of cages are available for ACDF, including Titanium (Ti) cages, Polyetheretherketone (PEEK) cages, and carbon fiber-reinforced polymer (CFRP) cages. PEEK cages are biocompatible, radiolucent and possess a modulus of elasticity similar to that of human cortical bone hence believed to improve fusion rates and allow for more accurate assessment with CT scan. However, PEEK cages can lead to complications such as cage subsidence, migration, adjacent segment disease, non-union, and kyphosis. There is insufficient evidence to support PEEK cages as the most effective interbody devices, and recent articles have shown adverse radiographic endplate changes when using PEEK cages, potentially resulting in nonunion.

Aim of the work

The aim of the work was to evaluate the cervical endplate changes following ACDF using PEEK cages by Computed Tomography.

Subjects and Methods

The study analyzed 46 patients with 96 levels treated with ACDF using PEEK cages in the spine unit at El-Hadara University Hospital between 2015 and 2023. The patients had a minimum 6-month follow-up. Cervical endplate changes and fusion status were evaluated using CT scan. The demographic data showed 43.5% males and 56.5% females, with a mean follow-up period of 30.87±25.37 months.

Results

Definite fusion was seen in 50 levels (52.1%) by observer 1 versus 52 levels (54.2%) by observer 2. The level of agreement was regarded as almost perfect. Vertebral endplate cavities (VECs) was observed in 30 levels (31.3%) by observer 1 versus 30 levels (31.3%) by observer 2 with almost perfect strength of agreement.

The characteristic features of the VECs showed that, majority were multiple in numbers, mostly found at C5-C6, small in size (<5mm) and located both caudal and cephalic as reported by both observers. Endplate sclerosis were in 4 levels (4.2%) by observer 1 versus 6 levels (6.3%) by observer 2 with moderate level of agreement. Follow-up period and fusion status were significantly related to the presence of VECs ($p \leq 0.05$), but levels fixed with PEEK cages, age, sex, history of cigarette smoking, and diagnosis showed no statistical significance with the presence of VECs.

Table (1): Comparison between observer 1 and observer 2 according to assessment of fusion in levels (n=96)

Observer 2	Observer 1						Total	
	Definite fusion		Questionable fusion		No fusion			
	No.	%	No.	%	No.	%	No.	%
Definite fusion	50	52.1	2	2.1	0	0.0	52	54.2
Questionable fusion	0	0.0	26	27.1	1	1.0	27	28.1
No fusion	0	0.0	3	3.1	14	14.6	17	17.7
Total	50	52.1	31	32.3	15	15.6	96	100.0
κ (p)	0.896 (<0.001*)							
Strength of agreement	Almost perfect agreement							
LL – UL 95% C.I	0.844 – 0.996							

Table (2): Comparison between observer 1 and observer 2 according to presence of VECs (n=96)

Observer 2	Observer 1				Total	
	Yes		No			
	No.	%	No.	%	No.	%
Yes	27	28.1	3	3.1	30	31.3
No	3	3.1	63	65.6	66	68.8
Total	30	31.3	66	68.8	96	100.0
κ (p)	0.855 (<0.001*)					
Strength of agreement	Almost perfect agreement					
LL – UL 95% C.I	0.742 – 0.967					

Table (3): Correlation between the presence of VECs with varying parameters

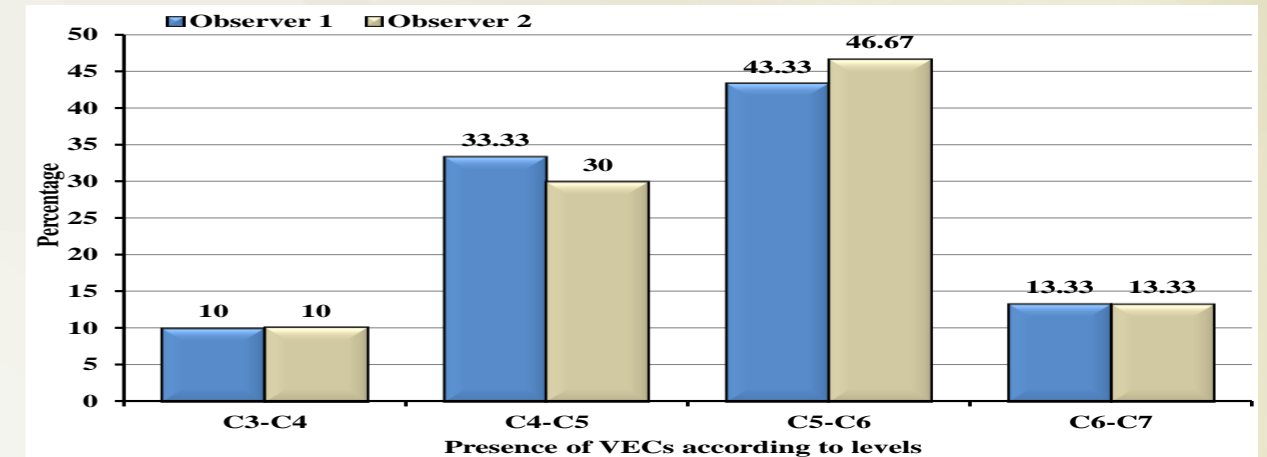| Variable	Observer 1		Observer 2	
	Test of significance	p	Test of significance	p
Follow-up	$c^2 = 9.552^*$	0.008*	$c^2 = 7.418^*$	0.024*
Fusion	$c^2 = 18.012^*$	<0.001*	$c^2 = 21.849^*$	<0.001*
Level of cage insertion	$c^2 = 2.612$	0.455	$c^2 = 2.382$	0.497
Cigarette smocking	$c^2 = 1.186$	0.276	$c^2 = 0.022$	0.883
Sex	$c^2 = 2.013$	0.156	$c^2 = 0.279$	0.597
Age	$c^2 = 0.055$	FEp=1.000	$c^2 = 0.152$	FEp=0.758
Diagnosis	$c^2 = 0.171$	0.679	$c^2 = 0.001$	0.978

Figure (1): Comparison between observer 1 and observer 2 regarding the presence of VECs according to levels (n=96)
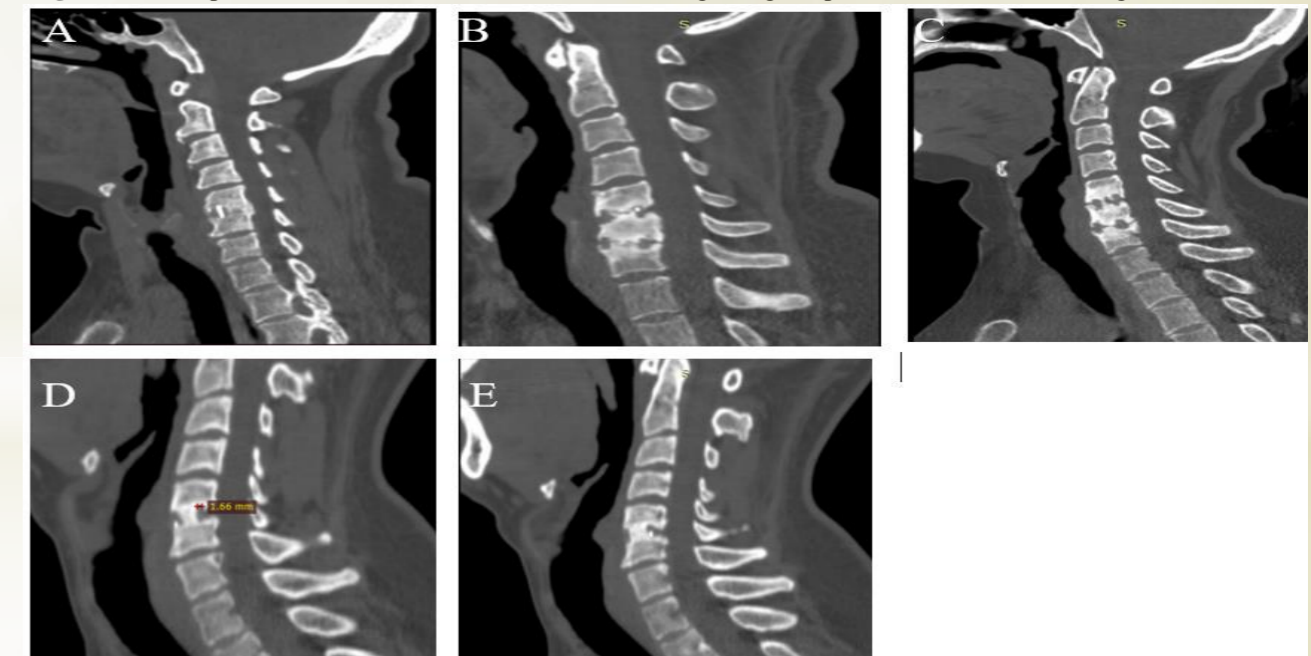

Figure (2): Fusion status and presence of VECs: (A) Definite fusion with no VECs. (B) Questionable fusion with multiple VECs (C) Nonunion with multiple small VECs (D, E) Definite fusion with single small(1.66mm) VEC, and sclerosis.

Conclusion

Our study confirmed that the radiographic findings of VECs were observed in a substantial number of patients following PEEK cage placement after ACDF procedures. They tend to be small (<5mm) in size and might be associated with non-union. A more reliable definition or method for this assessment should be formulated in future studies.