Clinical Article

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Cage Retropulsion after Posterior Lumbar Interbody Fusion by Unilateral stand-alone Carbon Cage

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Abstract

Background Data: Posterior lumbar interbody fusion (PLIF) becomes widely used surgical procedure to reduce pain and spinal instability resulting from some spinal diseases. Although this procedure is widely used, postoperative conditions such as good clinical outcome and spinal instability are still a matter of controversy. Maintenance of disc height and solid fusion significantly increased with PLIF with cage. Cage migration to the spinal canal is one of the most common cause of implant failure in mono-segmental lumbar interbody fusion.
Purpose: to evaluate the efficacy of unilateral stand-alone carbon cage in patients with degenerated lumbar disc disease
Study Design: A prospective follow-up study.
Patients and Methods: A prospective follow-up study was carried out on 40 patients (24 males and 16 females). All patients had single level lumbar disc prolapse, diagnosed clinically and radiologically, who admitted to Neurosurgery Department, Mansoura University Hospital and on Private work during the period from March 2013 to March 2015. On admission demographic data as age, gender, job and body mass index (BMI) were obtained for all patients. All patients were examined on admission clinically and radiologically by MRI lumbosacral spine and dynamic study plain x-ray films in extension and flexion views. Disc height was measured for all patients at the herniated level only, by MRI using Dabbs method. The outcome was measured according to modified Mac-Nab's criteria.
Results: Six cases out of 40 (15%) developed cage retropulsion. There was a lower significant mean age (38.3$\pm$2.96) for cases with cage retropulsion compared to (42.4$\pm$5.7) for those cases without cage retropulsion ($P<0.05$). However, the gender showed no significant difference with male predominance among both groups (with and without cage retropulsion)($P>0.05$). The majority of cases with cage retropulsion were obese (66.7%), while those without cage retropulsion were overweight (64.7%). L4-5 was the most common affected level (66.6%) among cases with cage retropulsion, and those without retropulsion were (70.6%). The majority of cases (5) with cage retropulsion (83.3%) had wide disc space height. Workers and carriers represented the majority of cases with cage retropulsion (33.3%). All cases (100%) with cage retropulsion had a poor outcome. However, the majority of cases with no cage retropulsion had excellent (50%) and good (11.8%) outcome according to the modified Mac-Nab's criteria.
Conclusion: Our data suggest that strenuous work, early heavy physical activities, large disc height may be contributing factors for cage retropulsion. Cage retropulsion has a negative impact on patients' outcome. (2017ESJ146)

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Keyword: cage retropulsion, lumbar fusion, lumbar disc disease, lumbar cage

Introduction

PLIF becomes widely used surgical procedure to reduce pain and spinal instability resulting from lumbar disc diseases.[14] PLIF was introduced by Ralph Cloward in 1940.[19,20] Although this procedure is widely accepted, debates still present regarding postoperative conditions such as good clinical outcome and spinal instability.[15] Autologous iliac bone graft was the most common choice for PLIF, but may lead to donor site morbidity such as pain and infection[3]. Local lamina bone and facet joint bone graft have superior effect in reducing morbidity.[13]

PLIF using stand-alone cage has been used to replace iliac crest tricortical grafting to reduce complications such as graft resorbtion and donor site morbidity. PLIF with stand-alone carbon cage help to maintain disc height and produce solid fusion.[8] The most common cause of implant failure in monosegmental lumbar interbody fusion is cage migration into the spinal canal leading to spinal deformity, malfusion and neurological deterioration.[2] Abbush et al,[1] reported that cage position and cage type seem to play a major role in cage migration after PLIF.

The aim of our study is the evaluation of the efficacy of unilateral stand-alone cage fusion as a simple procedure after lumbar discectomy to preserve spine stability and disc height, and to study the possible causes of cage retropulsion.

Patients and Methods

A prospective follow-up clinical case study was carried out on 40 cases (24 males and 16 females). All patients had single level lumbar disc prolapse, diagnosed clinically and radiologically. All patients operated during the period from March 2013 to March 2015 at Neurosurgery Department, Mansoura University Hospital were reported. All patients were complaining of low back pain and sciatica. Patients with multiple levels, instability, spondylolisthesis and infection were excluded. Demographic data as age, gender, job and body mass index (BMI) were reported for all patients.

Body mass index classified according to Garrouste et al,[9] was calculated by dividing weight of the patient in kilogram (kg) on the square of height in meter (m). All patients were examined on admission clinically and radiologically by Magnetic resonant image (MRI) lumbosacral spine and dynamic study plain x-ray films in extension and flexion views.

Disc height was measured for all patients at the herniated level by MRI. Disc level height was evaluated according to Egyptian parameters.[4]

All patients underwent open lumbar discectomy and PLIF using unilateral stand-alone carbon cage filled with autologus lamina bone. All patients wore lumbosacral brace for 3 months post-operative. All patients were evaluated postoperatively clinically and radiologically by dynamic plain x-ray lumbosacral spine 7 days, 3 months and one year. Patients with cage retropulsion were assessed by additional plain x-ray dynamic and MRI lumbosacral spine when needed guided by patient clinical data and clinical examination. Cage was considered retropulsed if displaced more than 2 ml and producing symptoms. Cages were revised surgically by the same surgical team using superadded pedicle screw fixation. Fusion was assessed by plain x ray films. The outcome has been assessed after one year postoperatively using modified Mac-Nab's criteria according to Lee et al,[15]

Results

Six cases out of 40 (15%) developed cage retropulsion. Patients with retropulsion were younger (38.3$\pm$2.96 years) than other patients (42.4$\pm$5.7 years) ($P<0.05$). There was no sex difference between retropulsion patients and others. Most retropulsion patients were obese (66.7%), while others were overweight (64.7%). The difference in body mass index between both group were statistically significant ($P<0.05$). Most retropulsion patients were workers (33.3%) and carriers (33.3%). (Table 1)

L4-5 disc was the most common affected level affecting 66.6% of retropulsion patients and 70.6% of others. 83.3% (N=5) of retropulsion patients had wide disc space height, while others had normal disc height in 58.8% of patients. The difference between both groups was statistically significant ($P<0.05$). (Table 2)

There was no significant difference regarding gender, body mass index and the level of cage retropulsion between both retropulsion patients and others. (Table 3)

The primary outcome of all patients with cage retropulsion was graded as a poor outcome. They were revised and their final outcome improved after. Other patients with no retropulsion had excellent (50%) and good (11.8%) outcomes. The difference in the outcome between both groups was statistically significant (P<0.05). (Table 3)

Table 1. Demographic Data of the Study Groups

Parameters		Total (N=40)		Retropulsion (N=6)		Others (N=34)	
		No.	%	No.	%	No.	%
Age (years)		41.95±55.6		38.3±2.96		42.4±5.7	
Age group/years	30- 40- 50-	16 19 5	40.0 47.5 12.5	4 2 0	66.7 33.3 0	12 17 5	35.3 50.0 14.7
Gender	Males Females	24 16	60 40	4 2	66.66 33.33	20 14	58.82 41.,17
BMI	Normal Over weight Obese	8 22 10	20 55 25	2 0 4	33.33 0 66.66	6 22 6	17.64 64.70 17.64
JOB	Clerical Carpenter Worker Carrier Driver Housewives Servants	3 3 7 9 4 8 6	7.5 7.5 17.5 22.5 10 20 15	0 0 2 2 0 1 1	0 0 33.3 33.3 0 16.6 16.6	3 3 5 7 4 7 5	8.8 8.8 14.7 20.5 11.7 20.5 14.7

Table 2. Clinical Characters of the Study Groups

Parameters		Total (N=40)		Retropulsion (N=6)		Others (N=34)		Test Significance	
		No.	%	No.	%	No.	%	Chi-square	T test
Cage Level	L3-4 L4-5 L5-S1	3 28 9	7.5 70 22.5	1 4 1	16.66 66.66 16.66	2 24 8	5.88 76.58 23.52	X^2= 0.909	N.S
Retropulsion Time	3 mos 4-6 mos 7-9 mos 12 mos	2 2 2 0	9 5 5 0	2 2 2 0	33.33 33.33 33.33 0	0 0 0 0	0 0 0 0	X^2=3.635	Sig. **
Disc height	Normal Wide	21 19	52.5 47.5	1 5	16.66 83.33	20 14	58.82 41.17	X^2=33.27	Sig. **
Mac-Nab criteria	Excellent Good Fair Poor	17 11 5 7	42.5 27.5 2.75 17.5	0 0 0 6	0 0 0 100	17 11 5 7	50.0 11.76 14.70 2.94		

Table 3. Factors Affecting Mac-Nab Outcome among Patients with Post Lumbar Interbody Fusion Using Unilateral Cage.

Parameters		Total (N=40)	Mac-Nab				Test of significance	
			Excellent (N=17)	Good (N=11)	Fair (N=5)	Poor (N=7)	Chi-square	P-value
Gender	Male Female	N=24 N=16	10 (64.70) 7 (41.17)	7 (63.6) 4 (36.3)	2 (40) 3 (60)	5 (71.4) 2 (28.5)	X^2=1.285	NS
BMI	Normal weight Over weight Obese	N=8 N=22 N=10	4 (23.52) 10 (58.8) 3 (17.64)	2 (18.18) 8 (72.72) 1 (9.09)	0 (0) 3 (60) 2 (40)	2 (28.57) 1 (14.23) 4 (57.14)	X^2=9.012	NS
Level	L3-4 L4-5 L5-S1	N=3 N=28 N=9	2 (11.76) 12 (70.58) 3 (17.64)	0 (0) 8 (72.72) 3 (27.27)	0 (0) 3 (60) 2 (40)	1 (14.28) 5 (71.4) 1 (14.28)	X^2=3.308	NS
Cage retropulsion	With Without	N=6 N=34	0 (0) 17 (100)	0 (0) 11 (100)	0 (0) 5 (100)	6 (100) 1 ( )	X^2=33.277	Sig. **
Disc height	Normal Wide	N=21 N=13	10 (58.82) 7 (41.17)	8 (72.72) 3 (27.27)	2 (40) 3 (60)	1 (14.28) 6 ( )	X^2=6.490	NS

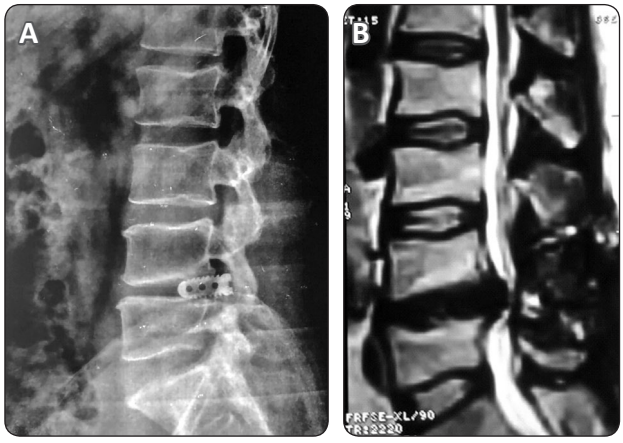

Figure 1. (A) lateral plain x-ray and (B) sagittal T2 weighted MRI of a retropulsed L4/5 cage 6 months following posterior lumbar interbody fusion.

Discussion

PLIF with carbon cage becomes widely used surgical procedure to eliminate pain and spinal instability.[14] In our series of 40 cases with single level lumbar discectomy and unilateral cage insertion, 6 cases developed posterior cage migration (15%). Eck et al,[6] reported that (14%) of cases with lumbar titanium cage developed cage retropulsion within 2 years follow up. Chen et al,[2] in their study reported cage migration of 16.7%.

In our series of PLIF with unilateral cage, the mean age for cage retropulsion patients were significantly lower (38.3±2.96 years) compared to patients with no cage retropulsion (42.4±5.7 years). Abbushi et al,[1] reported cage migration in patients over age 64 years in their study. Hiroak et al,[11] on their study on risk factors for cage retropulsion concluded a mean age of 68.2 years. Duncan and Bailey[5] on their study reported a mean age (53.5 years) of cases with cage retropulsion. Fathy et al,[8] on their study on outcome of cases after PLIF with cage reported that the mean age of cases with cage retropulsion was 36 years.

Personal factor such as job of patients performing strenuous work and heavy physical activities may be the contributing factors for cage retropulsion. In our series, the gender showed no significant difference with male predominance among both groups with and without cage retropulsion. These results were in agreement with Hiroak et al,[11] and Zhao et al,[19,20] who reported mail predominance. However, Hsiao et al,[12] Fathy et al,[8]. and Duncan et al,[5] reported a female predominance on their studies on cage retropulsion PLIF.

As regard body mass index of our series, the majority of cases with cage retropulsion were obese (66.7%), while those with no cage retropulsion were overweight (64.7%), the difference between both groups was statistically significant. Abbushi et al,[1] reported average body mass index of 27.5 kg/m^2 and Nixon et al,[17] found an average of 25.1 kg/m^2.

Regarding the time of cage retropulsion in our series no time difference was detected. Eshkenazi et al,[7] reported 10 days and 2 months for cage retropulsion of 2 patients after PLIF with cage. Hiroaki et al,[11] reported a time of 2 months for cage

retropulsion PLIF. Probably personal factor of age and body mass index play a role in time of cage retropulsion.

In our series the majority of cases with cage retropulsion (83.3%) had a wide disc space height. Hiroaki et al,[11] concluded that the disc height was significantly greater in patients with cage retropulsion. Lowe et al,[15] stated that large diameter cages have been shown to have a lower risk of cage migration than smaller diameter. Probably proper cage size and wide disc height contribute to cage retropulsion.

In our series L4-5 level was the most affected site (70.6%) in all patients who underwent PLIF with cage followed by L5-S1 (22.5%). The level of L4-5 was the most affected site (66.6%) in cases with cage retropulsion, that was in agreement with Nixon et al. (2014), who reported that the majority of cases were at L4-5 level (54.4%), followed by L5-S1 (26.47%). However, Hiroaki et al,[11] stated that L5-S1 level was the most common site for cage retropulsion.

As regard the outcome in our series with PLIF using unilateral carbon cage, all cases with cage retropulsion (100%) had a poor outcome, however, the majority of cases with no cage retropulsion had excellent (50%) and good (11.8%) outcomes. These results were in agreement with Zaho et al,[19,20] and Molinari et al,[16] who reported good outcome for patients with PLIF using unilateral cage. Fathy et al,[8] also reported that good and excellent outcome represent (4.5%) of cases with PLIF using unilateral cage. In contrast, Duncan et al,[5] reported that PLIF using unilateral cage insufficient stability and bad outcome. Poor outcome of patient with cage retropulsion may be due to neural compression, insufficient spine stability, malfusion, and excessive scar tissue. Workers and carriers represented (33.3%) of cases with cage retropulsion in our study may be due to their Strenuous work and heavy physical activities.

Conclusion

The data in this may suggest that strenuous work, early heavy physical activities, large disc height may be contributing factors for cage retropulsion. Cage retropulsion has a negative impact on patients' outcome.

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الملخص العربي

الطرد الخلفي للقفص بعد اللحام الخلفي البيني للفقرات القطنيه عبر قفص كربوني من جانب واحد

البيانات الخلفيه: يصبح الانصهار الداخلي الخلفي للقطني إجراءً جراحيًا واسع النطاق لتقليل الألم وعدم ثبات العمود الفقري الناتج عن بعض أمراض العمود الفقري و على الرغم من أن هذا الإجراء يستخدم على نطاق واسع ، إلا أن ظروف ما بعد الجراحة مثل النتائج السريرية الجيدة وعدم الاستقرار في العمود الفقري ما زالت موضع جدل.كما يعتبر هجرة الأقفاص إلى القناة الشوكية أحد أكثر الأسباب شيوعًا لفشل الغرسة في الاندماج بين الفقرات القطنية الأحادية.

الغرض: تقييم فعالية قفص الكربون قائم بذاته من جانب واحد في المرضى الذين يعانون من مرض القرص القطني المتدهور

تصميم الدراسة: دراسة متابعة مستقدمه.

المرضى والطرق: أجريت دراسة متابعة مستقبلية على 40 مريض (24 من الذكور و 16 من الإناث). كان لدى جميع المرضى تدل على قرص قطني واحد ، تم تشخيصهم سريريًا وإشعاعيًا ، والذين استقبلوا في قسم جراحةالمخ و الاعصاب بمستشفى المنصورة الجامعي والعمل الخاص خلال الفترة من مارس 2013 إلى مارس 2015.وعند دخول المرضى تم الحصول على البيانات الديموغرافية كالعمر والجنس والوظيفة وكتلة الجسم لجميع المرضى. تم فحص جميع المرضى على القبول سريريًا وشعاعيًا عن طريق التصوير بالرنين المغناطيسي القطني الفقري القطني وأفلام الأشعة السينية للدراسة الديناميكية في عروض الإرشاد والانثناءو تم قياس ارتفاع القرص لجميع المرضى على مستوى الانفتاق فقط ، بواسطة التصوير بالرنين المغناطيسي باستخدام طريقة Dabbs. تم قياس النتيجة وفقا لمعايير ماك-ناب المعدلة.

النتائج: ست حالات من أصل 40 (15 ٪) اطهرت ارتداد الأقفاص. كان هناك متوسط عمر منخفض أقل (38.3 + 2.96) للحالات مع ارتداد الأقفاص مقارنة بـ (42.4 + 5.7) لتلك الحالات دون ارتداد الأقفاص .ومع ذلك ، لم يُظهر النوع اختلافًا كبيرًا مع هيمنة الذكور بين كلتا المجموعتين (مع أو بدون استخدام الأقفاص) .وكانت غالبية الحالات التي استُخدمت في القفص عبارة عن بدينات (66.7٪) ، في حين كانت تلك الحالات التي لا تعاني من نقص في الأقفاص من الوزن الزائد (64.7٪). كان المستوى بين الفقرة الرابعة والخامسة القطنية أكثر المستويات تأثراً (66.6٪) بين الحالات التي استُخدمت في الأقفاص . وكانت غالبية الحالات (5) مع استرجاع القفص (83.3 ٪) تعاني من ارتفاع مساحة القرص على نطاق واسع. غالبية الحالات باسترجاع الأقفاص (33.3٪)هم العاملون والناقلون. جميع الحالات (100 ٪) مع ارتداد القفص كان لها نتائج سيئة. ومع ذلك ، فإن غالبية الحالات التي لا يوجد فيها استخدام في القفص قد حققت نتائج ممتازة (50 ٪) وجيدة (11.8 ٪) وفقا لمعايير ماك - ناب المعدلة.

الاستنتاج: تشير بياناتنا إلى أن العمل الشاق ، والأنشطة البدنية الثقيلة في وقت مبكر ، وارتفاع القرص الكبير قد يكون من العوامل التي تساهم في استرجاع القفص. ارتداد الأقفاص يؤثر تأثيراً سلبياً على نتائج المرضى.