

TABLE E-1 Demographic Data on the Patients

Case	Age	Preoperative Diagnosis	Indication for Retrieval	Level	Type of Surgery	Cage	Cage (N)	Graft Materials	Duration (Mo)
1	55	Spondylosis /Radiculopathy	Failed Fusion/Progressive Spondylosis	L5-S1	Laparoscopic	Carbon-fiber* ⁷	2	ICBG* ¹³	22
2	46	Spondylosis	Failed Fusion	L4-5	PLIF* ⁴	Carbon-fiber	1	DBM* ¹⁴	11
3	47	Spondylosis	Failed Fusion/Low Back Pain	L5-S1	ALIF* ⁵	Carbon-fiber	1	ICBG	13
4	32	DDD* ¹	Failed Fusion	L4-5	TLIF* ⁶	Carbon-fiber	1	Local* ¹⁵	12
5	59	Spondylolisthesis	Failed Fusion/Low Back Pain	L5-S1	PLIF	Carbon-fiber	2	Local	33
6	43	DDD	Failed Fusion/Low Back Pain	L4-5	TLIF	Carbon-fiber	1	Local	5
7	32	Spondylolisthesis	Low Back Pain	L5-S1	ALIF	InterFix* ⁸	2	ICBG	13
8	47	Spondylosis	Failed Fusion/Migration	L4-5	PLIF	InterFix	2	Local only	32
9	33	DDD	Failed Fusion	L4-5	PLIF	InterFix	1	Local+DBM	7
10	38	DDD	Migration/Infection	L5-S1	PLIF	InterFix	2	Local+DBM	3
11	40	NA* ²	NA	L5-S1	NA	InterFix	1	NA	NA
12	47	DDD	Malposition	L4-5	ALIF	BAK* ⁹	1	ICBG	9
13	70	Spondylolisthesis	L5 Compression Fracture	L4-5	PLIF	BAK	1	Local	2
14	57	Spondylolisthesis	Failed Fusion	L4-5	PLIF	BAK	2	Local	13
15	35	DDD	Infection	L5-S1	Laparoscopic	BAK	1	ICBG	13
16	71	Spondylosis	Progressive Spondylosis	L2-3 L3-4	PLIF	BAK	3	ICBG	22
17	NA	NA	NA	NA	NA	BAK	2	NA	NA
18	53	Spondylosis/DDD/Stenosis	Failed Fusion	L3-4	PLIF	BAK	1	Local	16
19	38	Spondylosis	Failed Fusion	L2-3	PLIF	BAK	2	Local	13
20	43	DDD	Failed Fusion/Malposition	L4-5	PLIF	BAK	2	Local	13
21	38	DDD	Failed Fusion	L5-S1	ALIF	BAK	1	ICBG	10
22	48	DDD	Failed Fusion/Malposition	L5-S1	PLIF	BAK	2	Local	36
23	34	HNP* ³	Failed Fusion	L3-4	PLIF	BAK	1	ICBG	31
24	NA	NA	NA	L4-5	NA	BAK	1	NA	NA
25	48	DDD	Failed Fusion	L4-5	PLIF	BAK	2	ICBG	87
26	33	DDD	Failed Fusion/Migration	L5-S1	Laparoscopic	BAK	1	Allograft	53
27	28	DDD	Failed Fusion	L4-5	PLIF	BAK	2	ICBG	49
28	36	DDD	Failed Fusion	L4-5	ALIF	BAK	1	ICBG	19
29	29	DDD	Failed Fusion/Malposition	L5-S1	ALIF	BAK	2	ICBG	39
30	28	NA	NA	NA	NA	Ray* ¹⁰	1	NA	NA
31	47	Spondylosis	Failed Fusion	L4-5	PLIF	Ray	2	Local+DBM	5
32	38	Spondylosis	Failed Fusion	L4-5 L5-S1	ALIF	Ray	3	ICBG	9
33	38	DDD	Failed Fusion	L4-5	PLIF	Ray	2	Local+ICBG	13
34	26	DDD	Failed Fusion/Malposition	L5-S1	PLIF	Ray	2	Local	12
35	44	Spondylosis	Malposition/Nerve Root Impingement	L5-S1	NA	Ray	1	Local+DBM	29
36	35	DDD	Failed Fusion	L4-5	PLIF	Ray	2	ICBG	16
37	42	NA	NA	NA	NA	Ray	2	NA	NA
38	51	NA	Failed Fusion	L3-4	PLIF	Ray	1	Local	30
39	44	DDD	Migration	L4-5	PLIF	Ray	2	Local	13
40	50	HNP	Migration	L3-4	PLIF	Ray	2	Local	20
41	48	Spondylolisthesis	Failed Fusion/Low Back Pain	L5-S1	PLIF	Ray	2	Allograft	35
42	43	Low Back Pain	Malposition	L5-S1	PLIF	Ray	1	Allograft	31
43	37	NA	Malposition/Nerve Root Impingement	L5-S1	ALIF	Ray	1	ICBG	26
44	45	NA	Failed Fusion	L5-S1	PLIF	Ray	2	Local	26
45	58	Spondylolisthesis	Failed Fusion	L5-S1	PLIF	Ray	2	NA	29
46	40	NA	Failed Fusion/Migration	L5-S1	PLIF	Ray	2	Local	4
47	50	DDD	Failed Fusion/Malposition	L5-S1	PLIF	LT* ¹¹	2	Local+ICBG	4
48	42	NA	Migration	L5-S1	NA	Aesculap* ¹²	2	NA	NA

*¹: Degenerative Disc Disease, *²: Not Available, *³: Herniated Nucleus Pulposus, *⁴: Posterior Lumbar Interbody Fusion, *⁵: Anterior Lumbar Interbody Fusion, *⁶: Transpedicular Lumbar Interbody Fusion, *⁷: Carbon-fiber reinforced polymer (DePuy AcroMed, Raynham, MA, USA), *⁸: InterFix cage (Medtronic Sofamor Danek, Memphis, TN, USA), *⁹: BAK cage (Spine-Tech, Minneapolis, MN, USA), *¹⁰: Ray cage (U.S. Surgical, Norwalk, CT, USA), *¹¹: Lumbar Tapered Fusion Device (Medtronic Sofamor Danek, Memphis, TN, USA), *¹²: Aesculap cage (Aesculap, South San Francisco, CA, USA), *¹³: Iliac crest autograft, *¹⁴: Demineralized Bone Matrix, *¹⁵: Local Autograft

TABLE E-2 Semiquantitative Grading of the Debris Particles

Grade	Average Number* of Macrophages per 1 HPF**
0	No phagocytosed macrophage identified
1	Visible phagocytosed macrophages in <5 HPFs
2	1 to 5 macrophages
3	6 to 10 macrophages
4	>10 macrophages

* Average number of macrophages in 5 HPFs containing maximum particles

**High-power visual field: $\times 400$

TABLE E-3 Percent Area Occupied by Each Tissue Type Within the Cages

Case	Type of Surgery	Cage	Graft	Duration (Mo)	Viable Bone	Necrotic Bone	Graft Materials	Fibrocartilage	Hyaline Cartilage	Fibrous Tissue	Debris Grade
1-1	Laparoscopic	Carbon-Fiber* ⁵	ICBG* ¹¹	22	75	5	-	10	0	10	4
1-2	Laparoscopic	Carbon-Fiber	ICBG	22	80	5	-	0	0	15	4
2	PLIF* ¹	Carbon-Fiber	DBM* ¹²	11	0	0	60	0	0	40	3
3	ALIF* ²	Carbon-Fiber	ICBG	13	20	10	-	25	10	35	4
4	TLIF* ³	Carbon-Fiber	Local* ¹³	12	0	15	-	30	0	55	3
5-1	PLIF	Carbon-Fiber	Local	33	75	10	-	5	0	10	1
5-2	PLIF	Carbon-Fiber	Local	33	60	10	-	15	0	15	1
6	TLIF	Carbon-Fiber	Local	5	10	20	-	5	5	60	1
7-1	ALIF	InterFix* ⁶	ICBG	13	45	5	-	20	0	30	3
7-2	ALIF	InterFix	ICBG	13	55	5	-	15	5	20	3
8-1	PLIF	InterFix	Local	32	20	5	-	15	0	60	0
8-2	PLIF	InterFix	Local	32	20	15	-	5	0	50	0
9	PLIF	InterFix	Local+DBM	7	0	20	0	20	0	60	0
10-1	PLIF	InterFix	Local+DBM	3	5	45	10	0	0	40	0
10-2	PLIF	InterFix	Local+DBM	3	10	50	10	0	0	30	0
11	NA* ⁴	InterFix	NA	NA	50	5	0	10	5	30	0
12	ALIF	BAK* ⁷	ICBG	9	50	30	-	10	0	10	4
13	PLIF	BAK	Local	2	20	40	-	30	0	10	0
14-1	PLIF	BAK	Local	13	0	70	-	5	5	20	2
14-2	PLIF	BAK	Local	13	10	70	-	10	0	10	1
15	Laparoscopic	BAK	ICBG	13	60	10	-	5	10	15	1
16-1	PLIF	BAK	ICBG	22	75	5	-	10	5	5	0
16-2	PLIF	BAK	ICBG	22	80	5	-	10	0	5	0
16-3	PLIF	BAK	ICBG	22	30	10	-	10	5	45	0
17-1	NA	BAK	NA	NA	65	5	0	20	0	10	2
17-2	NA	BAK	NA	NA	60	10	0	15	0	15	3
18	PLIF	BAK	Local	16	60	5	-	10	5	20	3
19-1	PLIF	BAK	Local	13	50	5	-	20	15	10	3
19-2	PLIF	BAK	Local	13	30	15	-	50	0	5	3
20-1	PLIF	BAK	Local	13	60	5	-	20	0	15	4
20-2	PLIF	BAK	Local	13	30	10	-	30	0	30	4
21	ALIF	BAK	ICBG	10	55	5	-	20	0	20	3
22-1	PLIF	BAK	Local	36	25	10	-	25	5	35	1
22-2	PLIF	BAK	Local	36	25	15	-	25	5	30	0
23	PLIF	BAK	ICBG	31	80	5	-	15	0	0	2
24	NA	BAK	NA	NA	65	30	0	5	0	0	0
25-1	PLIF	BAK	ICBG	87	15	5	-	50	5	25	3
25-2	PLIF	BAK	ICBG	87	40	5	-	30	5	20	4
26	Laparoscopic	BAK	Allograft	53	60	5	-	20	5	10	2
27-1	PLIF	BAK	ICBG	49	30	10	-	45	5	10	0
27-2	PLIF	BAK	ICBG	49	60	5	-	10	5	20	0
28	ALIF	BAK	ICBG	19	75	5	-	10	5	5	1
29-1	ALIF	BAK	ICBG	39	70	5	-	10	5	10	1
29-2	ALIF	BAK	ICBG	39	65	15	-	5	0	15	2
30	NA* ⁴	Ray* ⁸	NA	NA	70	10	0	15	0	5	3
31-1	PLIF	Ray	Local+DBM	5	20	10	40	10	5	15	0
31-2	PLIF	Ray	Local+DBM	5	55	0	20	20	0	5	0
32-1	ALIF	Ray	ICBG	9	10	50	-	20	0	20	2
32-2	ALIF	Ray	ICBG	9	10	30	-	10	0	50	2
32-3	ALIF	Ray	ICBG	9	20	30	-	0	0	50	2
33-1	PLIF	Ray	Local+ICBG	13	15	25	-	5	5	50	2
33-2	PLIF	Ray	Local+ICBG	13	20	50	-	10	5	15	3
34-1	PLIF	Ray	Local	12	75	5	-	15	0	5	2
34-2	PLIF	Ray	Local	12	70	5	-	5	0	20	2
35	NA	Ray	Local+DBM	29	40	10	20	20	0	10	2
36-1	PLIF	Ray	ICBG	16	40	10	-	15	0	35	3
36-2	PLIF	Ray	ICBG	16	70	10	-	5	0	15	1
37-1	NA	Ray	NA	NA	75	5	0	15	0	5	1
37-2	NA	Ray	NA	NA	70	5	0	10	0	15	2
38	PLIF	Ray	Local	30	55	10	-	10	5	20	3

TABLE E-3 (continued)											
39-1	PLIF	Ray	Local	13	70	5	-	10	5	10	2
39-2	PLIF	Ray	Local	13	70	5	-	15	5	5	2
40-1	PLIF	Ray	Local	20	0	70	-	5	10	15	0
40-2	PLIF	Ray	Local	20	0	35	-	40	5	20	0
41-1	PLIF	Ray	Allograft	35	55	5	-	25	10	5	0
41-2	PLIF	Ray	Allograft	35	60	5	-	25	0	10	1
42	PLIF	Ray	Allograft	31	20	40	-	25	0	25	1
43	ALIF	Ray	ICBG	26	70	0	-	20	0	10	2
44-1	PLIF	Ray	Local	26	80	0	-	15	0	5	0
44-2	PLIF	Ray	Local	26	70	0	-	20	0	10	0
45-1	PLIF	Ray	NA	29	65	5	0	15	5	5	2
45-2	PLIF	Ray	NA	29	50	10	0	25	0	5	1
46-1	PLIF	Ray	Local	4	40	20	-	30	0	20	1
46-2	PLIF	Ray	Local	4	0	20	-	0	0	80	0
47-1	PLIF	LT* ⁹	Local+ICBG	4	65	10	-	5	10	10	0
47-2	PLIF	LT	Local+ICBG	4	40	20	-	5	5	30	0
48-1	NA	Aesculap* ¹⁰	NA	NA	20	50	0	10	0	20	2
48-2	NA	Aesculap	NA	NA	60	20	0	0	0	20	0

*¹: Posterior Lumbar Interbody Fusion, *²: Anterior Lumbar Interbody Fusion, *³: Transpedicular Lumbar Interbody Fusion, *⁴: Not Available, *⁵: Carbon-fiber reinforced polymer (DePuy AcroMed, Raynham, MA, USA), *⁶: InterFix cage (Medtronic Sofamor Danek, Memphis, TN, USA), *⁷: BAK cage (Spine-Tech, Minneapolis, MN, USA), *⁸: Ray cage (U.S. Surgical, Norwalk, CT, USA), *⁹: Lumbar Tapered Fusion Device (Medtronic Sofamor Danek, Memphis, TN, USA), *¹⁰: Aesculap cage (Aesculap, South San Francisco, CA, USA), *¹¹: Iliac crest autograft, *¹²: Demineralized Bone Matrix, *¹³: Local Autograft