

## Letter to the Editor Regarding “The Top 100 Most-Cited Articles on Kyphoplasty and Vertebroplasty”



### LETTER:

Huang et al.<sup>1</sup> recently published an article in *World Neurosurgery* entitled “The top 100 most-cited articles on kyphoplasty and vertebroplasty”. Huang et al. mentioned in the Methods section that “On March 21, 2019, all databases of the Web of Science (specifically the Web of Science core database, KIC-Korean Journal Database, MEDLINE, Russian Science Citation Index, and SciELO Citation Index) were searched to identify the 100 most-cited articles on PKP and PVP research, with the exclusion of non-English studies. The keywords used were “vertebroplasty” and “kyphoplasty.” See the flowchart for the study design (Figure 1).” The authors commented “exclusion of non-English studies,” which means that most articles published in KIC-Korean Journal Database and most articles published in Russian Science Citation Index would not be included. The authors also mentioned in the original article “excluded based on title and abstract” in Figure 1 (Huang et al., 2020<sup>1</sup>). The authors missed articles entitled “Technological issues for the development of more efficient calcium phosphate bone cements: a critical assessment”<sup>2</sup> and “The effect of cement augmentation on the load transfer in an osteoporotic functional spinal unit: finite-element analysis”,<sup>3</sup> which include the keyword “vertebroplasty”.

Web of Science (<https://clarivate.com/webofsciencegroup/solutions/webofscience-platform/>) includes

1. Web of Science Core Collection
2. Data Citation Index
3. Derwent Innovations Index
4. BIOSIS Previews
5. Biological Abstracts
6. BIOSIS Citation Index
7. Current Contents Connect
8. Zoological Record
9. Inspec
10. CABI: CAB Abstracts
11. CABI: Global Health
12. MEDLINE
13. FSTA—the food science resource
14. Russian Science Citation Index
15. Chinese Science Citation Index
16. KCI-Korean Journal Database
17. SciELO Citation Index

Furthermore, Web of Science Core Collection includes

1. Science Citation Index Expanded (SCI-EXPANDED) (1900–present)
2. Social Sciences Citation Index (SSCI) (1900–present)
3. Arts & Humanities Citation Index (A&HCI) (1975–present)
4. Conference Proceedings Citation Index–Science (CPCI-S) (1990–present)
5. Conference Proceedings Citation Index–Social Science & Humanities (CPCI-SSH) (1990–present)
6. Book Citation Index–Science (BKCI-S) (2005–present)
7. Book Citation Index–Social Sciences & Humanities (BKCI-SSH) (2005–present)
8. Emerging Sources Citation Index (ESCI) (2015–present)

Web of Science Core Collection: Chemical Indexes

1. Current Chemical Reactions (CCR-EXPANDED) (1985–present)
2. Index Chemicus (IC) (1993–present)

Using all these different levels of databases in Web of Science is inappropriate for bibliometric studies.<sup>4,5</sup> Thus, the authors should choose appropriate databases for their bibliometric researches. The following results were obtained using the method in the original article<sup>1</sup> (data last updated 27 March, 2020).

Web of Science Core Collection (1900–present): 5411 documents including 172 documents with citations from Web of Science Core Collection  $\geq 100$  times

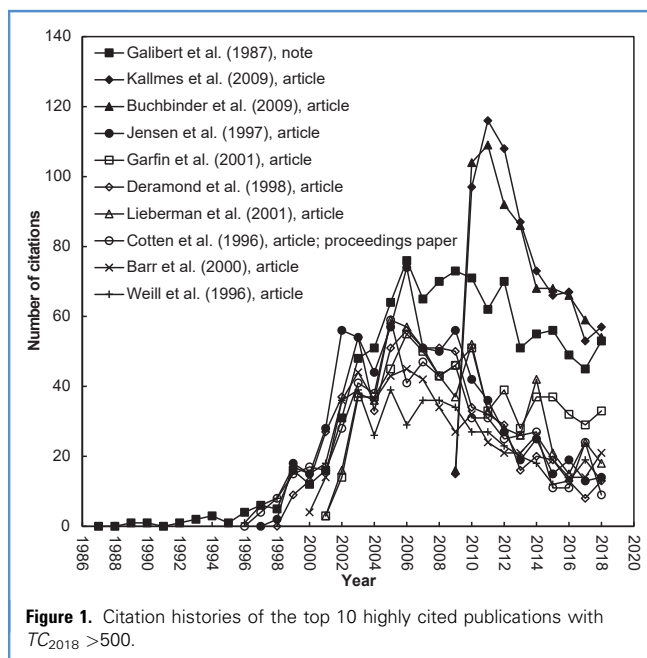
KCI-Korean Journal Database (1980–present): 286 documents including 0 documents with citations from Web of Science Core Collection  $\geq 100$  times

MEDLINE (1950–present): 4559 documents including 169 documents with citations from Web of Science Core Collection  $\geq 100$  times

Russian Science Citation Index (2005–present): 47 documents including 0 documents with citations from Web of Science Core Collection  $\geq 100$  times

SciELO Citation Index (2002–present): 46 documents including 0 documents with citations from Web of Science Core Collection  $\geq 100$  times

It has been pointed out that Web of Science is designed for researchers to find published literature but not for bibliometric studies.<sup>6–8</sup> Thus, understanding of the database used and an appropriate data treatment are always needed when using Web of Science for bibliometric studies.<sup>6</sup> Huang et al. (2020)<sup>1</sup> considered keywords contained in KeyWordsPlus, which provides the search terms extracted from the title of articles cited in each new article listed in Current Contents.<sup>9</sup> Because of the problem of searching words in KeyWordsPlus, Ho's group was the first to



propose a filter, named “front page,” including the titles, the abstracts, and author keywords, to improve the bibliometric method.<sup>10</sup> Those documents that can only be found by KeyWordsPlus were irrelevant to the search topic.<sup>11</sup>

Based on an idea from the original article (Huang et al., 2020<sup>5</sup>), an appropriate search strategy was used as follows:

Title = (“kypoplasty” or “vertebroplasty” or “vertebroplasties” or “kypoplasties” or “vertebroplastic” or “kypoplastiy” or “vertebroplastia”)

Timespan = 1990–2018

Indexes = SCI-EXPANDED

Data last updated March 27, 2020

This search resulted in 4695 documents. To improve the bias of using SCI-EXPANDED for bibliometric studies, the “front page” (including the document title, the abstract, and the author keywords) was proposed by Ho’s group in 2012.<sup>10</sup> According to 4695 documents, “front page” was applied as a filter. A total of 3717 kypoplasty-related and vertebroplasty-related documents were found. As a result, 2778 documents (59% of the 4695 documents) did not include search keywords in their “front page” (e.g., the highly cited articles entitled “Arthroscopic partial meniscectomy versus sham surgery for a degenerative meniscal tear”,<sup>12</sup> “Guidance on the management of pain in older people”,<sup>13</sup> and “Injectability of calcium phosphate pastes”<sup>14</sup>). It can be concluded that documents with search words in their “front page” can improve bibliometric studies.<sup>7</sup> Bibliometric articles

with the same problems were found in the medical-related journals (e.g., *Respiratory Medicine*,<sup>15</sup> *Medicine*,<sup>16</sup> *Rheumatology International*,<sup>17</sup> *World Neurosurgery*,<sup>18</sup> and *Annals of Surgical Treatment and Research*<sup>19</sup>). To stop publishing the same mistakes, comments were reported in *Toxicology and Industrial Health*,<sup>5</sup> *Scandinavian Journal of Hospitality and Tourism*,<sup>4</sup> *Frontiers in Pharmacology*,<sup>20</sup> *Cleft Palate-Craniofacial Journal*,<sup>21</sup> and *Chinese Medical Journal*.<sup>22</sup>

In 2011, Ho’s group recorded the total number of times that an article was cited from Web of Science Core Collection since its date of publication to the end of the most recent year under the heading  $TC_{year}$ .<sup>23–25</sup> The advantage of  $TC_{year}$  compared with the usual measure of total citations (TC) in the Web of Science Core Collection lies in its invariance, for it is not updated over time.<sup>26</sup> Highly cited articles was defined by Ho as  $TC_{year} \geq 100$ .<sup>27</sup> It was reported that highly cited articles might not be always highly cited after publication.<sup>28</sup> Similarly,  $C_{year}$  (the total number of citations of an article in the most recent year) was used as an indicator to evaluate article impact in the recent year.<sup>24,29</sup>

**Table 1** shows characteristics of 132 highly cited publications with  $TC_{2018} \geq 100$  in kypoplasty and vertebroplasty research with 2 citation indicators. Only 70 of the top 132 highly cited publications (53% of the 132 publications) were also ranked in the top 104 high-impact publications in 2018 with  $C_{2018} \geq 10$ . A comparison of citation histories of the top 10 highly cited publications with  $TC_{2018} > 500$  is shown in **Figure 1**. **Figure 2** shows citation histories of the top 11 the most-cited publications with highest impact in 2018 with  $C_{2018} > 30$ . Articles published in later years need time to accumulate citations. Articles by Clark et al. (2016)<sup>30</sup> and Anastasilakis et al. (2017)<sup>31</sup> had lower  $TC_{2018}$  of 52 and 39, respectively. However, these 2 articles had  $C_{2018}$  of 31 (ranked eighth) and 30 (ranked ninth) respectively. They had high impact in studies of kypoplasty and vertebroplasty. **Figure 3** shows citation histories of 7 highly cited publications with  $C_{2018} \leq 2$ . These publications had low impact in the most recent year of 2018.

Huang et al. (2020)<sup>1</sup> published “The top 100 most-cited articles on kypoplasty and vertebroplasty” in *World Neurosurgery* using inappropriate search words and methods. This situation may result in misleading readers of the journal.<sup>4,5,7,20,21,162</sup> It has been pointed out that authors have the duty to use accurate methods in their publications, reviewers have the responsibility to point out the mistakes, and journal editors have to pay more attention to such problems in articles that are being accepted for publication.<sup>7</sup> It is not helpful for researchers to duplicate the same problems again and again without improving their research.<sup>7,8,21</sup>

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*Conflict of interest statement:* The author declares that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

<https://doi.org/10.1016/j.wneu.2020.04.012>

**Table 1.** Characteristics of 132 Highly Cited Publications with  $TC_{2018} \geq 100$  in Kyphoplasty and Vertebroplasty Research

Rank ( $TC_{2018}$ )	Rank ( $C_{2018}$ )	Title (Document Type)	Reference
1 (1058)	3 (53)	A treatment method for certain spinal angiomas: percutaneous vertebroplasty with acrylic cement (note)	32
2 (739)	1 (57)	A randomized trial of vertebroplasty for osteoporotic spinal fractures (article)	33
3 (722)	2 (54)	A randomized trial of vertebroplasty for painful osteoporotic vertebral fractures (article)	34
4 (715)	50 (14)	Percutaneous polymethylmethacrylate vertebroplasty in the treatment of osteoporotic vertebral body compression fractures: technical aspects (article)	35
5 (649)	7 (33)	New technologies in spine: kyphoplasty and vertebroplasty for the treatment of painful osteoporotic compression fractures (article)	36
6 (616)	57 (13)	Percutaneous vertebroplasty with polymethylmethacrylate: technique, indications, and results (article)	37
7 (599)	31 (18)	Initial outcome and efficacy of "kyphoplasty" in the treatment of painful osteoporotic vertebral compression fractures (article)	38
8 (598)	105 (9)	Percutaneous vertebroplasty for osteolytic metastases and myeloma: effects of the percentage of lesion filling and the leakage of methyl methacrylate at clinical follow-up (article, proceedings paper)	39
9 (517)	18 (21)	Percutaneous vertebroplasty for pain relief and spinal stabilization (article)	40
10 (512)	57 (13)	Spinal metastases: indications for and results of percutaneous injection of acrylic surgical cement (article)	41
11 (434)	6 (39)	Efficacy and safety of balloon kyphoplasty compared with non-surgical care for vertebral compression fracture (FREE): a randomised controlled trial (article)	42
12 (427)	39 (16)	Percutaneous vertebroplasty and kyphoplasty for painful vertebral body fractures in cancer patients (article)	43
13 (417)	39 (16)	Long-term observations of vertebral osteoporotic fractures treated by percutaneous vertebroplasty (article)	44
14 (416)	9 (30)	Vertebroplasty and kyphoplasty: a systematic review of 69 clinical studies (review)	45
15 (414)	4 (46)	Palliative radiotherapy for bone metastases: an astro evidence-based guideline (article)	46
16 (409)	4 (46)	Vertebroplasty versus conservative treatment in acute osteoporotic vertebral compression fractures (Vertos II): an open-label randomised trial (article)	47
17 (353)	18 (21)	Occurrence of new vertebral body fracture after percutaneous vertebroplasty in patients with osteoporosis (article)	48
18 (350)	95 (10)	Percutaneous vertebroplasty: state of the art (article, proceedings paper)	49
19 (336)	259 (5)	Percutaneous vertebroplasty in the treatment of osteoporotic vertebral compression fractures: an open prospective study (article)	50
20 (320)	57 (13)	The biomechanics of vertebroplasty: the effect of cement volume on mechanical behavior (article)	51
21 (313)	50 (14)	Percutaneous vertebroplasty: a developing standard of care for vertebral compression fractures (review)	52
22 (307)	105 (9)	Pulmonary embolism caused by acrylic cement: a rare complication of percutaneous vertebroplasty (article)	53
23 (297)	128 (8)	Percutaneous vertebroplasty guided by a combination of ct and fluoroscopy (article)	54
24 (293)	95 (10)	Percutaneous transpedicular vertebroplasty with PMMA: operative technique and early results—a prospective study for the treatment of osteoporotic compression fractures (article)	55
24 (293)	44 (15)	Adjacent vertebral failure after vertebroplasty: a biomechanical investigation (article)	56
26 (290)	26 (19)	Technological issues for the development of more efficient calcium phosphate bone cements: a critical assessment (article)	2

Continues

Table 1. Continued

Rank ( <i>TC</i> <sub>2018</sub> )	Rank ( <i>C</i> <sub>2018</sub> )	Title (Document Type)	Reference
27 (269)	31 (18)	Effects of bone cement volume and distribution on vertebral stiffness after vertebroplasty (article)	57
28 (267)	57 (13)	Vertebroplasty: cement leakage into the disc increases the risk of new fracture of adjacent vertebral body (article)	58
29 (261)	95 (10)	Vertebral compression fractures: pain reduction and improvement in functional mobility after percutaneous polymethylmethacrylate vertebroplasty-retrospective report of 245 cases (article)	59
30 (242)	50 (14)	Incidence of subsequent vertebral fracture after kyphoplasty (article)	60
30 (242)	18 (21)	New fractures after vertebroplasty: adjacent fractures occur significantly sooner (article)	61
32 (238)	31 (18)	The effect of cement augmentation on the load transfer in an osteoporotic functional spinal unit: finite-element analysis (article)	3
33 (233)	128 (8)	Percutaneous vertebroplasty for osteoporotic compression fractures: quantitative prospective evaluation of long-term outcomes (article, proceedings paper)	62
34 (229)	105 (9)	Management of acute osteoporotic vertebral fractures: a nonrandomized trial comparing percutaneous vertebroplasty with conservative therapy (article)	63
35 (228)	511 (3)	Kyphoplasty in the treatment of osteolytic vertebral compression fractures as a result of multiple myeloma (article)	64
36 (222)	34 (17)	Percutaneous vertebroplasty compared with optimal pain medication treatment: short-term clinical outcome of patients with subacute or chronic painful osteoporotic vertebral compression fractures. The VERTOS study (article)	65
37 (221)	95 (10)	Treatment of painful osteoporotic vertebral fractures with percutaneous vertebroplasty or kyphoplasty (review)	66
38 (202)	44 (15)	Balloon kyphoplasty and vertebroplasty for vertebral compression fractures: a comparative systematic review of efficacy and safety (review)	67
39 (200)	511 (3)	Biomechanical efficacy of unipedicular versus bipedicular vertebroplasty for the management of osteoporotic compression fractures (article)	68
40 (198)	44 (15)	Leakage of cement in percutaneous transpedicular vertebroplasty for painful osteoporotic compression fractures (article)	69
41 (196)	259 (5)	An in vivo comparison of the potential for extravertebral cement leak after vertebroplasty and kyphoplasty (article)	70
42 (192)	39 (16)	Comparison of vertebroplasty and balloon kyphoplasty for treatment of vertebral compression fractures: a meta-analysis of the literature (article)	71
42 (192)	728 (2)	Percutaneous vertebroplasties. Technique and indications (review)	72
44 (183)	259 (5)	An ex vivo biomechanical evaluation of an inflatable bone tamp used in the treatment of compression fracture (article)	73
44 (183)	34 (17)	Injectable bone cements for use in vertebroplasty and kyphoplasty: state-of-the-art review (review)	74
46 (181)	259 (5)	Prospective evaluation of pain relief in 100 patients undergoing percutaneous vertebroplasty: results and follow-up (article)	75
46 (181)	50 (14)	Load shift of the intervertebral disc after a vertebroplasty: a finite-element study (article)	Baroud et al. (2003) <sup>76</sup>
48 (180)	12 (29)	Balloon kyphoplasty versus non-surgical fracture management for treatment of painful vertebral body compression fractures in patients with cancer: a multicentre, randomised controlled trial (article)	77
49 (178)	196 (6)	The dynamic mobility of vertebral compression fractures (article)	78
50 (176)	128 (8)	Percutaneous vertebroplasty: functional improvement in patients with osteoporotic compression fractures (article)	79
51 (175)	511 (3)	Balloon kyphoplasty: one-year outcomes in vertebral body height restoration, chronic pain, and activity levels (article)	80

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Table 1. Continued

Rank ( <i>TC</i> <sub>2018</sub> )	Rank ( <i>C</i> <sub>2018</sub> )	Title (Document Type)	Reference
51 (175)	149 (7)	Society of Interventional Radiology quality improvement guidelines for percutaneous vertebroplasty (article)	81
53 (174)	511 (3)	A review of complications associated with vertebroplasty and kyphoplasty as reported to the Food and Drug Administration Medical Device Related Web Site (review)	82
54 (171)	259 (5)	Early radiographic and clinical results of balloon kyphoplasty for the treatment of osteoporotic vertebral compression fractures (article)	83
54 (171)	105 (9)	Risk factors of new compression fractures in adjacent vertebrae after percutaneous vertebroplasty (article)	84
54 (171)	57 (13)	Pulmonary embolism of polymethyl methacrylate during percutaneous vertebroplasty and kyphoplasty (article)	85
57 (168)	128 (8)	Augmentation of mechanical properties in osteoporotic vertebral bones: a biomechanical investigation of vertebroplasty efficacy with different bone cements (article)	86
58 (167)	354 (4)	Vertebroplasty: clinical experience and follow-up results (article, proceedings paper)	87
59 (166)	149 (7)	Percutaneous vertebroplasty for severe osteoporotic vertebral body compression fractures (article)	88
59 (166)	105 (9)	Balloon kyphoplasty in the management of vertebral compression fractures: an updated systematic review and meta-analysis (review)	89
61 (164)	149 (7)	Major neurological complications following percutaneous vertebroplasty with polymethylmethacrylate: a case report (article)	90
62 (162)	149 (7)	Temperature elevation caused by bone cement polymerization during vertebroplasty (article, proceedings paper)	91
63 (161)	44 (15)	Surgical management of spinal metastases (article)	92
63 (161)	259 (5)	Treatment of painful vertebral fractures by kyphoplasty in patients with primary osteoporosis: a prospective nonrandomized controlled study (article)	93
63 (161)	24 (20)	Primary pedicle screw augmentation in osteoporotic lumbar vertebrae: biomechanical analysis of pedicle fixation strength (article)	94
66 (159)	354 (4)	Percutaneous transpedicular polymethyl methacrylate vertebroplasty for the treatment of spinal compression fractures (article)	95
67 (156)	259 (5)	Dose-dependent epidural leakage of polymethylmethacrylate after percutaneous vertebroplasty in patients with osteoporotic vertebral compression fractures (article)	96
68 (155)	511 (3)	Biomechanical evaluation of a new bone cement for use in vertebroplasty (article)	97
69 (153)	511 (3)	Percutaneous vertebroplasty (article)	98
70 (152)	17 (22)	Risk of fracture after single fraction image-guided intensity-modulated radiation therapy to spinal metastases (article)	99
71 (148)	259 (5)	Percutaneous balloon kyphoplasty for the correction of spinal deformity in painful vertebral body compression fractures (article)	100
71 (148)	259 (5)	Balloon kyphoplasty is effective in deformity correction of osteoporotic vertebral compression fractures (article)	101
73 (147)	354 (4)	Acute osteoporotic vertebral collapse: open study on percutaneous injection of acrylic surgical cement in 20 patients (article)	102
73 (147)	57 (13)	The characteristics of a hydroxyapatite-chitosan-PMMA bone cement (article)	103
73 (147)	259 (5)	Clinical outcomes after acute osteoporotic vertebral fractures: a two-year non-randomised trial comparing percutaneous vertebroplasty with conservative therapy (review)	104
76 (144)	74 (12)	Use of injectable calcium phosphate cement for fracture fixation: a review (article)	105
76 (144)	196 (6)	Percutaneous vertebroplasty: long-term clinical and radiological outcome (article)	106

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Table 1. Continued

Rank ( <i>TC</i> <sub>2018</sub> )	Rank ( <i>C</i> <sub>2018</sub> )	Title (Document Type)	Reference
76 (144)	18 (21)	Balloon kyphoplasty versus vertebroplasty for treatment of osteoporotic vertebral compression fracture: a prospective, comparative, and randomized clinical study (article)	107
79 (140)	57 (13)	Vertebroplasty and kyphoplasty for the treatment of vertebral compression fractures: an evidenced-based review of the literature (article)	108
79 (140)	728 (2)	Percutaneous vertebroplasty in patients with osteolytic metastases or multiple myeloma (review)	109
81 (139)	354 (4)	The effect of vertebral body percentage fill on mechanical behavior during percutaneous vertebroplasty (article)	110
82 (138)	196 (6)	Primary and secondary osteoporosis' incidence of subsequent vertebral compression fractures after kyphoplasty (article)	111
83 (137)	105 (9)	A lethal pulmonary embolism during percutaneous vertebroplasty (article)	112
83 (137)	74 (12)	Cement leakage during vertebroplasty: an underestimated problem (article)	113
83 (137)	259 (5)	Percutaneous vertebroplasty for spinal metastases: complications (article)	114
83 (137)	14 (27)	The role of polymethylmethacrylate bone cement in modern orthopaedic surgery (review)	115
87 (135)	259 (5)	Kyphoplasty for vertebral compression fractures: one-year clinical outcomes from a prospective study (article)	116
88 (134)	9 (30)	International myeloma working group recommendations for the treatment of multiple myeloma-related bone disease (article)	117
89 (128)	196 (6)	Temperature measurement during polymerization of polymethylmethacrylate cement used for vertebroplasty (review)	118
89 (128)	196 (6)	Ionic modification of calcium phosphate cement viscosity. Part I: hypodermic injection and strength improvement of apatite cement (article)	119
89 (128)	57 (13)	Spinal extradural metastasis: review of current treatment options (article)	120
92 (127)	16 (25)	Twelve-months follow-up in forty-nine patients with acute/semiacute osteoporotic vertebral fractures treated conservatively or with percutaneous vertebroplasty: a clinical randomized study (article)	121
93 (126)	149 (7)	Bone substitutes in vertebroplasty (article)	122
93 (126)	354 (4)	Vertebroplasty, first 1000 levels of a single center: evaluation of the outcomes and complications (article, proceedings paper)	123
95 (125)	354 (4)	Diagnosis and management of vertebral fractures in elderly adults (article)	124
95 (125)	511 (3)	Balloon kyphoplasty for the treatment of pathological vertebral compressive fractures (review)	125
97 (124)	87 (11)	Minimally invasive treatments of osteoporotic vertebral compression fractures (article)	126
98 (123)	57 (13)	Surgery insight: current management of epidural spinal cord compression from metastatic spine disease (review)	127
99 (121)	149 (7)	The risk of new osteoporotic vertebral compression fractures in the year after percutaneous vertebroplasty (article)	128
100 (120)	34 (17)	Management of pulmonary cement embolism after percutaneous vertebroplasty and kyphoplasty: a systematic review of the literature (review)	129
101 (119)	1791 (0)	Percutaneous vertebroplasty treatment of steroid-induced osteoporotic compression fractures (article)	130
102 (118)	511 (3)	Value of bone scan imaging in predicting pain relief from percutaneous vertebroplasty in osteoporotic vertebral fractures (article)	131
102 (118)	149 (7)	Vertebroplasty and kyphoplasty for osteolytic vertebral collapse (article)	132
104 (117)	1103 (1)	Kyphoplasty for treatment of osteoporotic vertebral fractures: a prospective non-randomized study (article)	133

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Table 1. Continued

Rank ( <i>TC</i> <sub>2018</sub> )	Rank ( <i>C</i> <sub>2018</sub> )	Title (Document Type)	Reference
104 (117)	18 (21)	Randomized controlled trial of percutaneous vertebroplasty versus optimal medical management for the relief of pain and disability in acute osteoporotic vertebral compression fractures (article)	134
106 (116)	87 (11)	Increased pedicle screw pullout strength with vertebroplasty augmentation in osteoporotic spines (article)	135
106 (116)	149 (7)	Intravertebral clefts opacified during vertebroplasty: pathogenesis, technical implications, and prognostic significance (article, proceedings paper)	136
106 (116)	259 (5)	Midterm outcome after vertebroplasty: predictive value of technical and patient-related factors (article)	137
109 (115)	39 (16)	Assessment of different screw augmentation techniques and screw designs in osteoporotic spines (article)	138
110 (114)	354 (4)	CT-guided interventional procedures for pain management in the lumbosacral spine (article, proceedings paper)	139
110 (114)	354 (4)	Biomechanical evaluation of an injectable calcium phosphate cement for vertebroplasty (review)	140
110 (114)	196 (6)	Occupational exposure from common fluoroscopic projections used in orthopaedic surgery (article, proceedings paper)	141
110 (114)	74 (12)	Percutaneous treatment of vertebral compression fractures: a meta-analysis of complications (article)	142
114 (113)	105 (9)	Management of pulmonary embolism during acrylic vertebroplasty (article)	143
115 (112)	1103 (1)	Percutaneous vertebroplasty in benign and malignant disease (article)	144
116 (111)	728 (2)	Treatment of thoracolumbar burst fractures with polymethyl methacrylate vertebroplasty and short-segment pedicle screw fixation (article)	145
117 (110)	354 (4)	RETRACTED: Paradoxical cerebral arterial embolization of cement during intraoperative vertebroplasty: case report (Retracted Article. See vol 25, pg B1, 2004) (article)	146
117 (110)	259 (5)	Is percutaneous vertebroplasty without pretreatment venography safe? Evaluation of 205 consecutive procedures (review)	147
117 (110)	259 (5)	Efficacy and safety of balloon kyphoplasty in the treatment of vertebral compression fractures: a systematic review (article, retracted publication)	148
117 (110)	196 (6)	High-viscosity cement significantly enhances uniformity of cement filling in vertebroplasty: an experimental model and study on cement leakage (article)	149
121 (108)	149 (7)	Complications of percutaneous vertebroplasty and their prevention (review)	150
121 (108)	105 (9)	Prospective study of standalone balloon kyphoplasty with calcium phosphate cement augmentation in traumatic fractures (article)	151
123 (107)	259 (5)	Kyphosis correction and height restoration effects of percutaneous vertebroplasty (article)	152
124 (106)	259 (5)	Age of fracture and clinical outcomes of percutaneous vertebroplasty (article, proceedings paper)	153
125 (105)	354 (4)	Fat embolism and acute hypotension during vertebroplasty: an experimental study in sheep (article)	154
125 (105)	39 (16)	Balloon kyphoplasty for the treatment of acute vertebral compression fractures: two-year results from a randomized trial (article)	155
127 (104)	511 (3)	Unilateral transpedicular percutaneous vertebroplasty: initial experience (article)	156
127 (104)	511 (3)	Painful osteoporotic vertebral fracture: pathogenesis, evaluation, and roles of vertebroplasty and kyphoplasty in its management (article)	157
127 (104)	196 (6)	Balloon kyphoplasty for symptomatic vertebral body compression fractures results in rapid, significant, and sustained improvements in back pain, function, and quality of life for elderly patients (review)	158

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Table 1. Continued

Rank ( $TC_{2018}$ )	Rank ( $C_{2018}$ )	Title (Document Type)	Reference
130 (102)	128 (8)	Minimal invasive stabilization of osteoporotic vertebral fractures: a prospective nonrandomized comparison of vertebroplasty and balloon kyphoplasty (article)	159
131 (101)	354 (4)	Reduction of pain and fracture incidence after kyphoplasty: one-year outcomes of a prospective controlled trial of patients with primary osteoporosis (article)	160
132 (100)	1791 (0)	Quality of life following vertebroplasty (article)	161

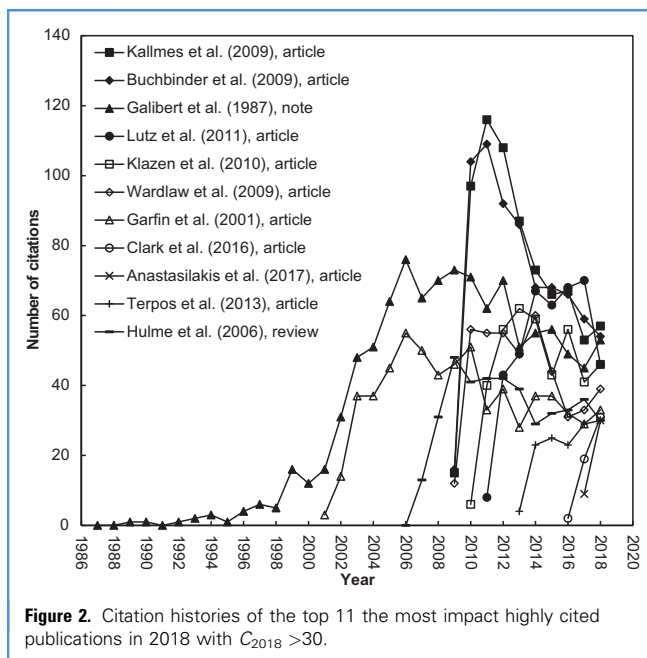


Figure 2. Citation histories of the top 11 the most impact highly cited publications in 2018 with  $C_{2018} > 30$ .

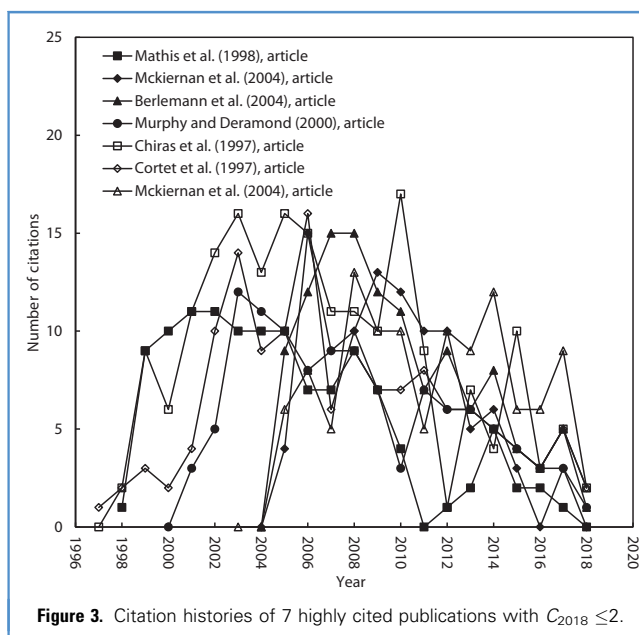


Figure 3. Citation histories of 7 highly cited publications with  $C_{2018} \leq 2$ .



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