Trends in Reimbursement and Approach Selection for Lumbar Arthrodesis

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BACKGROUND: Changes in reimbursement policies have been demonstrated to correlate with clinical practice.

OBJECTIVE: To investigate trends in physician reimbursement for anterior, posterior, and combined anterior/posterior (AP) lumbar arthrodesis and relative utilization of AP.

METHODS: We queried the American College of Surgeons National Surgical Quality Improvement Project registry for anterior, posterior, and AP lumbar arthrodeses during 2010 and 2020. Work relative value units per operative hour (wRVUs/h) were calculated for each procedure. Trends in reimbursement and utilization of the AP approach were assessed with linear regression. Subgroup analyses of age and underlying pathology of AP arthrodesis were also performed.

RESULTS: During 2010 and 2020, AP arthrodesis was associated with significantly higher average wRVUs/h compared with anterior and posterior arthrodesis (AP = 17.4, anterior = 12.4, posterior = 14.5). The AP approach had a significant yearly increase in wRVUs/h (coefficient = 0.48, $P = .042$), contrary to anterior (coefficient = −0.01, $P = .308$) and posterior (coefficient = −0.13, $P = .006$) approaches. Utilization of AP approaches over all arthrodeses increased from 7.5% in 2010 to 15.3% in 2020 (yearly average increase 0.79%, $P < .001$). AP fusions increased significantly among both degenerative and deformity cases (coefficients 0.88 and 1.43, respectively). The mean age of patients undergoing AP arthrodesis increased by almost 10 years from 2010 to 2020. Rates of major 30-day complications were 2.7%, 3.1%, and 3.5% for AP, anterior, and posterior arthrodesis, respectively.

CONCLUSION: AP lumbar arthrodesis was associated with higher and increasing reimbursement (wRVUs/h) during the period 2010 to 2020. Reimbursement for anterior arthrodesis was relatively stable, while reimbursement for posterior arthrodesis decreased. The utilization of the combined AP approach relative to the other approaches increased significantly during the period of interest.

KEY WORDS: Anterior-posterior fusion, Circumferential fusion, Lumbar arthrodesis, 360 arthrodesis, Reimbursement, Relative value units

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Drivers of healthcare costs and physician reimbursements have increasingly become an area of interest to payors and health systems alike. Alternative payment models,[1,2] such as those proposed under the Affordable Care Act, have emphasized care quality,[3] using metrics such as readmission rates and patient satisfaction scores. These alternative payment models have, in turn, led many payors to re-examine how procedures are reimbursed and many health systems to reconsider how physicians are compensated.

CMS and most other major payors reimburse physicians based on the work relative value unit (wRVU).[4] A recent examination of the Neurosurgery Executives' Resource Value and Education Society showed that neurosurgeon compensation strongly correlates with the number of wRVUs performed.[4] Consequently, the system is structured with a built-in incentive for surgeons to

ABBREVIATIONS: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Project; **ALIF,** anterior lumbar interbody fusion; **AP,** anterior-posterior; **BPM,** bundled payment model; **CPT,** *Current Procedural Terminology*; **PLIF,** posterior lumbar interbody fusion; **RVU,** relative value unit; **wRVU,** work relative value unit.

increase their surgical volume and selectively offer higher wRVU procedures in cases where 2 or more alternative procedures have demonstrated clinical equipoise. One such situation of interest is the case of degenerative lumbar disease requiring instrumented fusion.

Currently, more than 80 lumbar fusions per 100 000 population are performed annually for degenerative disease.[5] In many of these patients, anterior-posterior and posterior approaches have been suggested to have similar or better outcomes regarding radiographic fusion[6] and patient-reported metrics.[7] However, anterior-posterior procedures can be assigned both anterior and posterior *Current Procedural Terminology* (*CPT*) fusion codes, enabling them to receive higher wRVU allotment. The objective of this national study was to investigate trends in RVUs per unit time assigned to those procedures and potential correlations of these payment trends with trends in utilization of the various approaches for lumbar arthrodesis.

METHODS

The American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) Participant Use Files for years 2010 to 2020 were queried for all cases with *CPT* codes for anterior/anterolateral (22558) or posterior/posterolateral (22612, 22633, 22630) lumbar arthrodesis. Cases with both anterior-approach and posterior-approach CPTs were classified as "anterior-posterior" (AP), while the remaining patients were categorized in the "anterior-only" or the "posterior-only" groups. Categorization of cases to groups relied solely on the approach of arthrodesis, irrespective of whether posterior instrumentation with screws and rods was performed. The outcomes of interest were the yearly proportion of patients treated with each approach and the wRVUs per hour of surgery (wRVUs/h) for each surgical approach. To calculate the number of segments fused, we used the *CPT* codes 22585 for anterior surgery and 22614, 22632, 22634 for posterior surgery. For AP approaches, the maximal number of segments treated between the 2 approaches was selected.

To assess trends in patient characteristics between the AP fusion group and the overall cohort, we compared the yearly mean age of the AP group with that of the remaining patients. In addition, we investigated trends in treatment allocation among the subpopulations of degenerative and deformity cases. We defined degenerative and deformity cases based on *ICD-9* and *ICD-10* codes, as previously presented.[8] We also evaluated the rate of major 30-day complications in each approach group cumulatively and yearly. Major complications were defined as previously described.[9]

This study was exempt from Institutional Review Board approval and did not require patient consent because it used deidentified data from a national registry. Data used in this study are available to all participants in the ACS-NSQIP registry.

Statistical Analysis

Continuous data are presented in means and SD, while categorical data are presented as frequencies and proportions. The unpaired 2-sample *t*-test was performed for continuous outcomes, while the Pearson χ^2 test was performed for categorical. Trend analysis was performed for wRVUs/h, utilization of AP arthrodesis overall and among degenerative and deformity cases, mean age of groups, and per-group complication rate. These variables were analyzed as a function of surgery year using linear regression. The association of each variable with the surgery year was presented as coefficient and 95% CIs. Statistical significance was defined as $P < .05$. All statistical analyses were performed using the R statistical environment (version 4.2.0).[10]

RESULTS

Patient Population

Of the 79 216 patients undergoing lumbar arthrodesis, 52 133 (65.8%) were subjected to posterior-only fusion, 17 640 (22.3%) to anterior-only fusion, and 9443 (11.9%) to AP fusion. The cohort's mean age was 60.9 years, and 53.9% of the patients were female (Table 1). AP fusion was less likely than the total aggregate to be performed in an outpatient setting (1.8% vs 4.6%) and more likely to have deformity as an underlying pathology (26.5% vs 19.2%).

Number of Segments Treated

The average number of segments fused in the overall cohort was 1.57 (SD = 0.84), with 57.2% of the arthrodeses being single segment and 33.8% being 2 segment. Posterior approach was associated with the highest number of segments fused (1.65, SD = 0.90), followed by AP (1.55, SD = 0.72) and anterior approach (1.34, SD = 0.61). Within the 11 years studied, AP arthrodesis was associated with a statistically but not clinically significant decreasing mean number of segments treated (coefficient = −0.01, $P < .001$). The trend was not statistically significant for anterior (coefficient <0.01, $P = .497$) or posterior arthrodesis (coefficient <0.01, $P = .930$).

Trends in Reimbursement

For anterior arthrodesis, the average wRVUs/h was 12.4, ranging from 11.5 in 2010 to 13 in 2015 (Table 2). Reimbursement for anterior arthrodesis was relatively stable, and no trend was observed (coefficient = −0.01; $P = .823$; Figure 1).

For posterior arthrodesis, the mean wRVUs/h was 14.5, ranging from 13.6 in 2019 to 15.2 in 2013 and 2014 (Table 2). There was a decreasing trend in reimbursement for posterior arthrodesis, documented as an average yearly decrease of 0.13 wRVUs/h (95% CI: [−0.21] to [−0.06]; $P = .006$; Figure 1).

For AP arthrodesis, the average reimbursement was 17.4 wRVUs/h, ranging from 13.1 in 2010 to 19.8 in 2015 (Table 2). A significant peak in reimbursement was noted during 2015 to 2017, and the overall trend was increasing, with an average increase of 0.48 wRVUs/h per year (95% CI: 0.06-0.71; $P = .042$; Figure 1). When adjusted for the mean number of segments fused, this trend analysis yielded no statistical significance (coefficient = 0.26, 95% CI: −0.22 to 0.74), suggesting that the observed trend in increasing reimbursement for AP arthrodesis was partially mediated by the performance of fewer-segment operations.

Trends in Utilization

Lumbar arthrodesis was performed using a combined anterior-posterior approach in 11.9% of the cases from 2010 to 2020. The per-year percentage of AP cases over the total arthrodeses presented a

TABLE 1. Characteristics of Patients Undergoing Anterior, Posterior, and AP Fusion

	Anterior fusion N = 17 640	Posterior fusion N = 52 133	AP fusion N = 9443	Total N = 79 216	*P* value
Age, mean (SD)	56.6 (13.4)	62.8 (12.9)	58.5 (13.1)	60.9 (13.3)	<.001
Female sex	9232 (52.3%)	28 313 (54.3%)	5147 (54.5%)	42 692 (53.9%)	<.001
Diabetes mellitus					
No	15 007 (85.1%)	41 683 (80.0%)	7944 (84.1%)	64 634 (81.6%)	<.001
Insulin-dependent	862 (4.9%)	3470 (6.7%)	450 (4.8%)	4782 (6.0%)	
Non–insulin-dependent	1771 (10.0%)	6980 (13.4%)	1049 (11.1%)	9800 (12.4%)	
Congestive heart failure	52 (0.3%)	249 (0.5%)	22 (0.2%)	323 (0.4%)	<.001
Chronic obstructive pulmonary disease	692 (3.9%)	2671 (5.1%)	336 (3.6%)	3699 (4.7%)	<.001
Bleeding disorder	188 (1.2%)	862 (1.9%)	91 (1.1%)	1141 (1.6%)	<.001
Nonavailable	2246	6026	1097	9369	
Functional status					
Independent	17 195 (97.5%)	50 372 (96.6%)	9255 (98.0%)	76 822 (97.0%)	<.001
Partially dependent	360 (2.0%)	1405 (2.7%)	151 (1.6%)	1916 (2.4%)	
Totally dependent	24 (0.1%)	78 (0.1%)	7 (0.1%)	109 (0.1%)	
Unknown	61 (0.3%)	278 (0.5%)	30 (0.3%)	369 (0.5%)	
Emergency case	77 (0.4%)	567 (1.1%)	17 (0.2%)	661 (0.8%)	<.001
Indication for surgery/postoperative diagnosis					
Degenerative disease	9405 (53.3%)	25 531 (49.0%)	4610 (48.8%)	39 546 (49.9%)	<.001
Deformity	3589 (20.3%)	9100 (17.5%)	2502 (26.5%)	15 191 (19.2%)	
Other	4646 (26.3%)	17 502 (33.6%)	2331 (24.7%)	24 479 (30.9%)	
Outpatient surgery	532 (3.0%)	2940 (5.6%)	173 (1.8%)	3645 (4.6%)	<.001

AP, anterior-posterior.

minimum of 5.9% in 2011 and a maximum of 15.3% in 2020 (Table 3). Cumulatively, there was an increasing trend in utilization of AP approaches among lumbar arthrodeses, with an average absolute increase of 0.79% per year (95% CI: 0.54-1.05; $P < .001$; Figure 2).

Trends in Age and Underlying Pathology

The average age of patients undergoing anterior or posterior arthrodesis increased slightly within the years of interest (coefficient = 0.29; 95% CI: 0.21–0.38; $P < .001$; Figure 3). The minimum average age was noted in 2011 (59.4 years), and the maximum in 2018 and 2020 (62.5 years). The average age of patients undergoing AP fusion increased more significantly from 2010 to 2020, from age 51.1 to 62.5 years. The average yearly increase in mean age for the AP group was 0.82 years (95% CI :0.60-1.04; $P < .001$; Figure 3).

Among patients undergoing lumbar arthrodesis for underlying degenerative pathology, 11.7% were subjected to an AP fusion.

TABLE 2. Average RVUs Per Hour for Anterior, Posterior, and AP Fusion From 2010 to 2020

Anterior fusion													
Year of surgery	2010 N = 283	2011 N = 589	2012 N = 790	2013 N = 1122	2014 N = 1545	2015 N = 2074	2016 N = 2160	2017 N = 2267	2018 N = 2246	2019 N = 2514	2020 N = 2050	Total N = 17 640	*P* value
RVUs/h	11.5 (7.9)	12.6 (7.9)	12.5 (7.5)	12.5 (8.2)	12.8 (8.6)	13.0 (13.6)	12.4 (9.9)	12.3 (8.7)	12.1 (10.0)	12.3 (12.4)	11.9 (9.6)	12.4 (10.2)	<.001

Posterior fusion													
Year of surgery	2010 N = 1637	2011 N = 3350	2012 N = 3203	2013 N = 3960	2014 N = 5080	2015 N = 5622	2016 N = 5967	2017 N = 6038	2018 N = 6026	2019 N = 6209	2020 N = 5041	Total N = 52 133	*P* value
RVUs/h	14.5 (7.9)	15.1 (14.4)	14.9 (8.9)	15.2 (45.9)	15.2 (22.6)	14.7 (9.1)	14.7 (9.7)	14.4 (9.1)	13.9 (9.4)	13.6 (8.4)	13.9 (9.0)	14.5 (16.9)	<.001

AP fusion													
Year of surgery	2010 N = 156	2011 N = 246	2012 N = 317	2013 N = 600	2014 N = 847	2015 N = 1107	2016 N = 1206	2017 N = 1291	2018 N = 1097	2019 N = 1295	2020 N = 1281	Total N = 9443	*P* value
RVUs/h	13.1 (5.4)	14.2 (7.3)	15.2 (12.6)	15.9 (9.9)	16.3 (8.4)	19.8 (26.6)	18.8 (13.7)	19.3 (14.5)	16.4 (10.0)	16.6 (10.0)	17.1 (12.2)	17.4 (14.3)	<.001

AP, anterior-posterior; RVUs, relative value units.

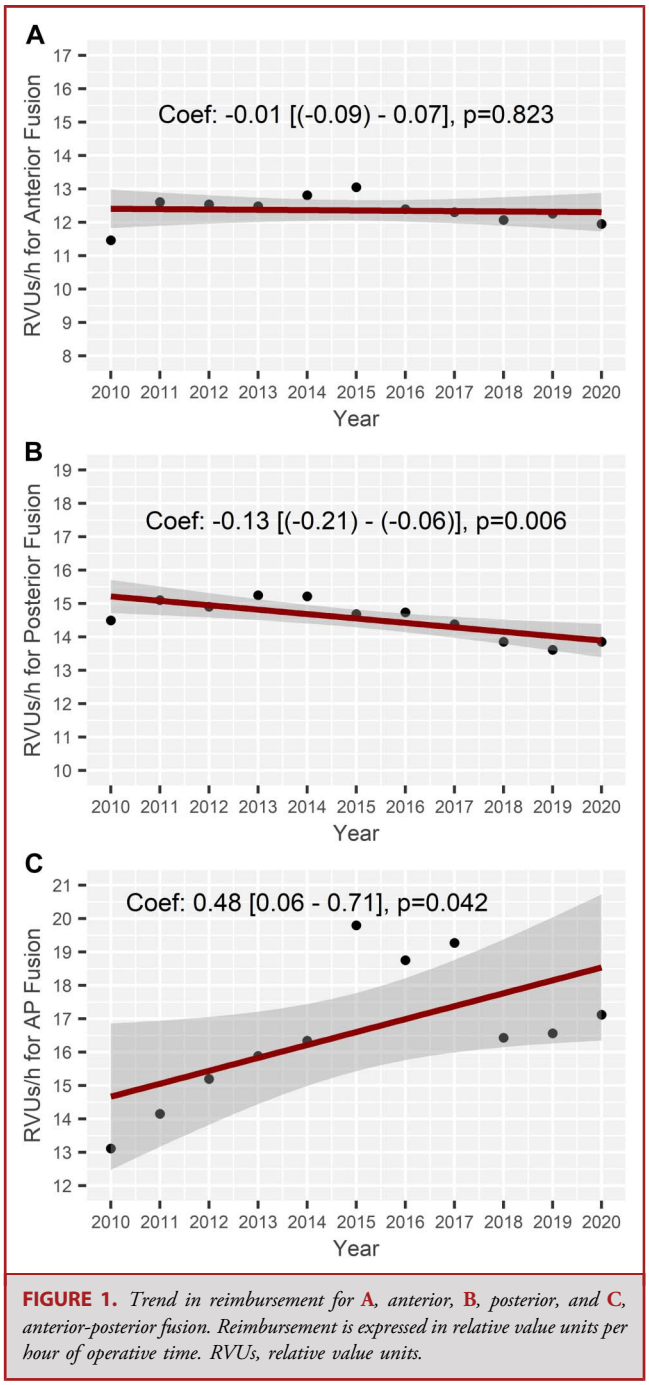

FIGURE 1. *Trend in reimbursement for* **A**, *anterior,* **B**, *posterior, and* **C**, *anterior-posterior fusion. Reimbursement is expressed in relative value units per hour of operative time. RVUs, relative value units.*

This percentage ranged from 6% in 2011 to 16.4% in 2019 (Table 4). Across the 11-year period of interest, the percentage of degenerative cases allocated to the AP group increased by an absolute average of 0.88% yearly (95% CI: 0.64-1.21; $P < .001$; Figure 4). The proportion of patients subjected to AP fusion among deformity cases was 16.5%, and it presented a steady increase from 3.9% in 2010 to 22.5% in 2020. The coefficient for this upward trend was 1.43 (95% CI: 0.88-1.97; $P < .001$; Figure 4).

Major 30-Day Complications

The overall rate of major complications among the 79 126 lumbar fusion cases analyzed was 3.3%. The posterior approach had the highest complication rate (3.5%), followed by the anterior and the AP approaches (3.1% and 2.7%, respectively). The difference between the 3 groups was statistically significant ($P < .001$) yet numerically minor. An analysis of trends in complication rates yielded a statistically significant increase in complication rates after posterior surgeries (coefficient = 0.02, $P = .024$) but not after anterior (coefficient = 0.03, $P = .076$) or AP surgery (coefficient <0.01, $P = .99$). The per-year complication rates for the 3 approaches are presented in Figure 5.

DISCUSSION

In this study, we examined an 11-year sample from the ACS-NSQIP registry for changes in utilization of anterior-only, posterior-only, and combined anterior-posterior arthrodeses, along with changes in the wRVUs/h allotted to those cases. It was found that over the period examined, there was a significant increase in AP or anterior-only procedures. These results are similar to those reported by Pannell et al[11] based on a 2004 to 2009 sample from the PearlDiver database. Unlike the former study, we also examined wRVUs reimbursement changes for the distinct anatomic approaches. We found that while the wRVUs/h were relatively stagnant for anterior-only fusions and decreased for posterior-only fusions, they increased for AP fusions.

Our analysis also found that AP arthrodesis was performed in a population of increasing age. This phenomenon could be attributed to the gradual familiarization of providers with combined approaches or improved perioperative management, imbuing surgeons with more confidence to safely subject older patients to higher-morbidity AP operations.[12] In addition, we found the AP approach to be increasingly used in shorter-segment fusions. This partially explained the increasing reimbursement associated with the AP approach during the past decade and potentially translates into an increasing application of the combined approach to less severe cases. Nevertheless, the number of segments fused is a crude measure of case complexity, and this hypothesis requires verification in a more granular data set. Geographic variations in approach selection and inflation-adjusted Medicare reimbursement may also contribute to the observed reimbursement trend, but there has yet to be a direct examination of this correlation.[13,14]

AP arthrodesis offers more robust constructs because of the circumferential design and the increased bone surface available for fusion.[15] Thus, AP arthrodesis is often elected for degenerative cases complicated by deformity or instability, potentially offering superior deformity correction and patient-reported outcomes.[15,16] However, a recent meta-analysis failed to demonstrate such a benefit.[17] Regarding cost-effectiveness, it has been suggested that dual-approach

TABLE 3. Proportion of Fusion Approaches Per Year From 2010 to 2020

	2010 N = 2076	2011 N = 4185	2012 N = 4310	2013 N = 5682	2014 N = 7472	2015 N = 8803	2016 N = 9333	2017 N = 9596	2018 N = 9369	2019 N = 10 018	2020 N = 8372	Total N = 79 216
Anterior fusion	283 (13.6%)	589 (14.1%)	790 (18.3%)	1122 (19.7%)	1545 (20.7%)	2074 (23.6%)	2160 (23.1%)	2267 (23.6%)	2246 (24.0%)	2514 (25.1%)	2050 (24.5%)	17 640 (22.3%)
Posterior fusion	1637 (78.9%)	3350 (80.0%)	3203 (74.3%)	3960 (69.7%)	5080 (68.0%)	5622 (63.9%)	5967 (63.9%)	6038 (62.9%)	6026 (64.3%)	6209 (62.0%)	5041 (60.2%)	52 133 (65.8%)
AP fusion	156 (7.5%)	246 (5.9%)	317 (7.4%)	600 (10.6%)	847 (11.3%)	1107 (12.6%)	1206 (12.9%)	1291 (13.5%)	1097 (11.7%)	1295 (12.9%)	1281 (15.3%)	9443 (11.9%)

AP, anterior-posterior.

fusion performs inferiorly to single-approach fusion[18,19]; nevertheless, the lack of long-term follow-up considering reoperation rates decreases the impact of these findings. Overall, the low-quality available evidence suggests the need for further investigation into which patients benefit from AP vs single-approach arthrodesis.

Spine Work Valuation Models

In response to regulatory efforts to curtail medical spending, compensation and reimbursement have been moving increasingly toward bundled payment models (BPM),[20] which use a single lump sum for all services associated with a specific procedure.[2] While proponents argue such models re-emphasize value and the avoidance of unnecessary procedures,[20] the evidence for this is unclear, with a population-level data set and single-institutional series finding no appreciable difference in 90-day care costs after BPM implementation.[21,22] Interestingly, Bronson et al[22] provided some evidence that BPM implementation may be associated with changes in clinical decision-making, such as higher interbody fusion usage, more rapid hospital discharge, and increased rates of discharge to a skilled nursing facility or home with a health aide, as opposed to inpatient rehabilitation.

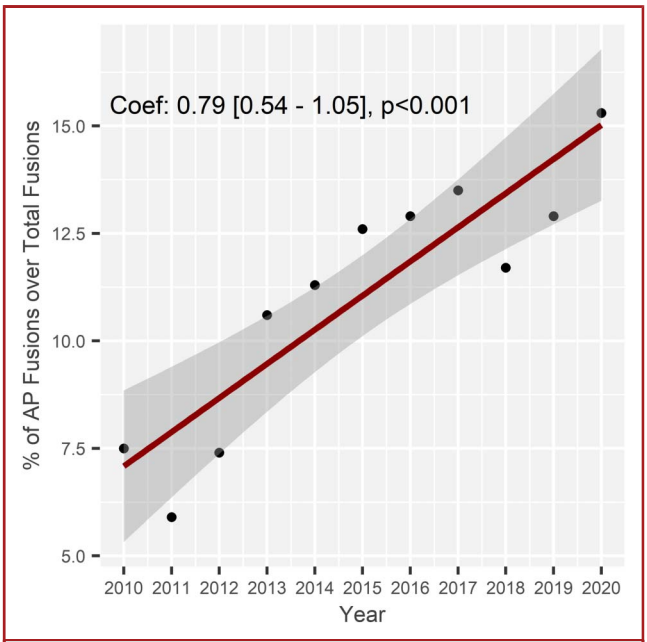

FIGURE 2. *Trend in utilization of AP arthrodesis. AP, anterior-posterior.*

Procedure complexity complicates the implementation of BPMs in spine because the use of diagnosis-related groups (DRGs)—an inherent part of BPMs—leads to the clustering of extremely heterogeneous surgeries. In an examination by Malik et al,[23] a DRG-based reimbursement model for lumbar fusion failed to account for significant cost variations associated with differences in approach, number of fused levels, and interbody device utilization. Existing risk stratification algorithms also fail to account for crucial comorbidities, namely diabetes mellitus and osteoporosis. A second study by Orr et al[24] similarly suggested CPT-based billing may compensate short-segment lumbar fusions better than long-segment constructs. Consequently, implementation of current models may force health systems and surgeons to take on uncompensated financial risk.[2]

At the same time, BPMs highlight the role of procedural code reimbursements. Wang et al[25] showed that reimbursements for posterior lumbar fusions decreased with a compound annualized rate of −1.2% for commercial payors and −0.63% for Medicare. These decreases persisted even after accounting for the procedure-related wRVUs. Interestingly, a contemporary examination[26] showed the opposite trend in hospital compensations between 2010 and 2016, suggesting health systems and surgeons may have conflicting interests concerning BPMs. The present examination adds to this by illustrating that over the same period that surgeon compensation for posterior approaches has been decreasing, there has been an increase in the proportion of cases treated with anterior-only and anterior-posterior approaches. More specifically, posterior approaches recorded a 25% decrease in utilization within the last 11 years, while the rates of anterior-only and AP approaches almost doubled during this period.

These trends should be interpreted in the context of improvements in surgical technologies for anterolateral approaches and the rising experience and evidence supporting anterior lumbar interbody fusion.[27,28] Nevertheless, by identifying that anterior-posterior approaches enable surgeons to accumulate more wRVUs/h, these data could also suggest that some surgeons may alter their surgical

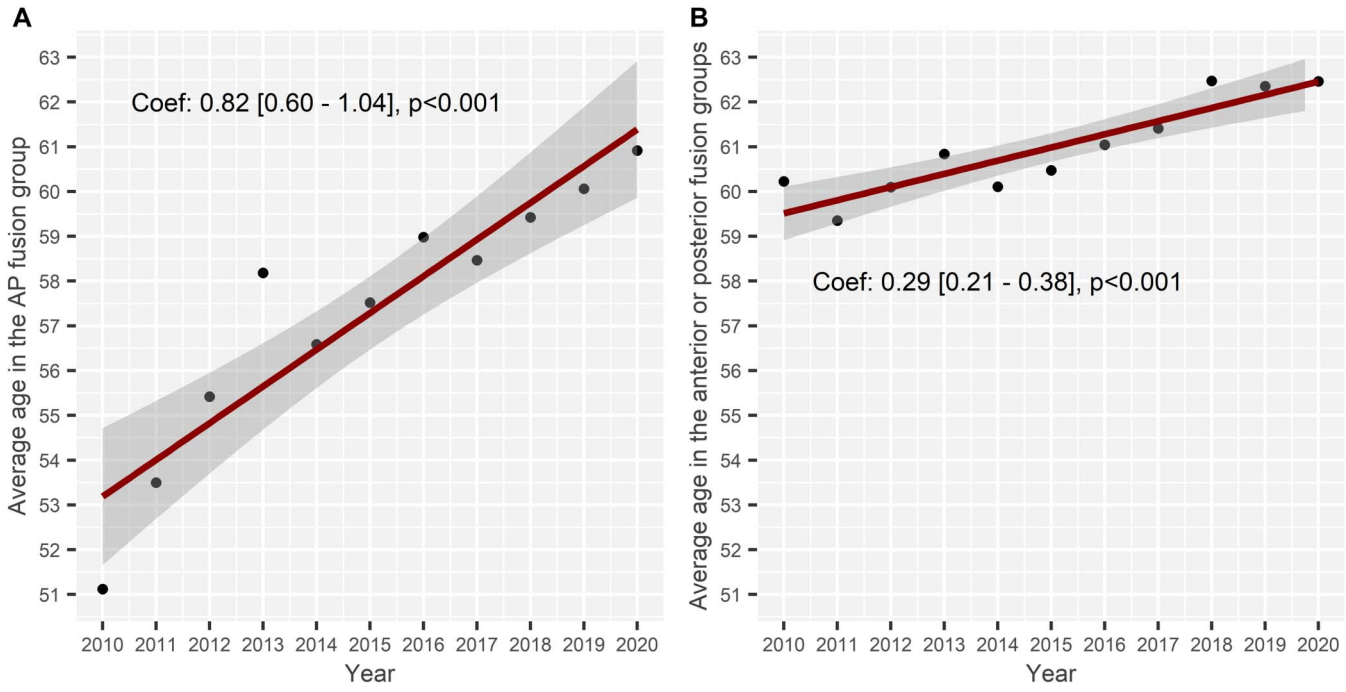

FIGURE 3. *Average age per year for patients undergoing* **A**, *anterior or posterior fusion and for patients undergoing* **B**, *AP fusion. AP, anterior-posterior.*

approach to increase their number of billable wRVUs. The present results can by no means identify any causality to this relationship; instead, they suggest that the association between changing practices and compensation schemata merits further investigation.

Prior Examinations of wRVUs as a Function of Surgical Approach to Lumbar Fusion

There have been relatively few prior examinations of relative value unit productivity as a function of anatomic approach in lumbar spine surgery. Using the NSQIP, Sodhi et al[29] compared the mean wRVUs and wRVUs/minute for anterior lumbar interbody fusion (ALIF) and posterior lumbar interbody fusion (PLIF). The authors found that PLIFs had longer operative times and ALIFs had higher mean wRVUs assigned and a 22% higher wRVUs/minute, which they calculated could translate to an annual compensation difference of nearly $80 000. Similar findings were reported by Qureshi et al[30] using the PearlDiver database for Medicare patients. They found that ALIF procedures had 30-day and 90-day reimbursements that were $4790 and $5834 higher than PLIF after adjusting for comorbidities, age,

TABLE 4. Patients Undergoing AP Fusion Per Indication

	Degenerative cases												
No. of cases	2010 N = 1295	2011 N = 2487	2012 N = 2586	2013 N = 3330	2014 N = 4540	2015 N = 5471	2016 N = 5784	2017 N = 5938	2018 N = 2854	2019 N = 2780	2020 N = 2481	Total N = 39 546	*P* value
AP fusion	117 (9.0%)	148 (6.0%)	182 (7.0%)	335 (10.1%)	505 (11.1%)	648 (11.8%)	723 (12.5%)	745 (12.5%)	425 (14.9%)	376 (13.5%)	406 (16.4%)	4610 (11.7%)	<.001
	Deformity cases												
No. of cases	2010 N = 258	2011 N = 626	2012 N = 587	2013 N = 796	2014 N = 941	2015 N = 1406	2016 N = 2278	2017 N = 2340	2018 N = 2062	2019 N = 2172	2020 N = 1725	Total N = 15 191	*P* value
AP fusion	10 (3.9%)	40 (6.4%)	64 (10.9%)	104 (13.1%)	160 (17.0%)	246 (17.5%)	392 (17.2%)	431 (18.4%)	296 (14.4%)	371 (17.1%)	388 (22.5%)	2502 (16.5%)	<.001

AP, anterior-posterior.

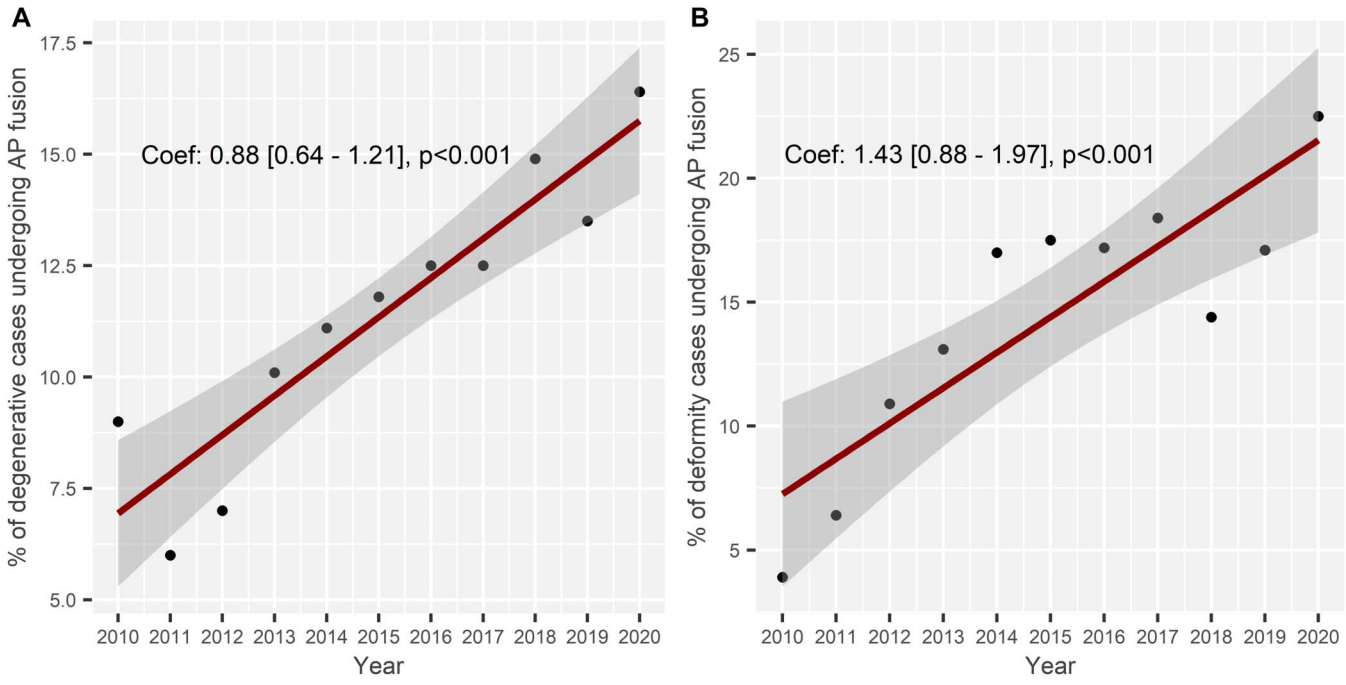

FIGURE 4. *Proportion of patients undergoing AP fusion over the total number of* A*, degenerative and* B*, deformity cases. AP, anterior-posterior.*

and sex. Unlike the present investigation, neither of the aforementioned studies considered changes in wRVU assignment over time or the correlation of wRVU valuation with approach selection. We believed this is a key point of interest meriting further investigation.

Limitations

Importantly, the limited granularity of the ACS-NSQIP database prevents the investigation of parameters guiding surgical decision-making—underlying pathologies, symptomatology, and radiographic parameters—and, therefore, this large-scale analysis

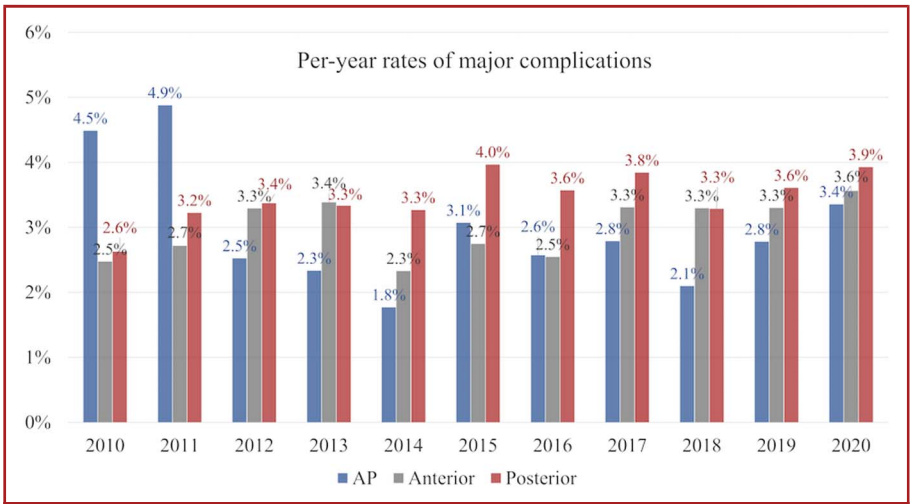

FIGURE 5. *Per-year rates of major 30-day complications after lumbar fusion using an AP, anterior, and posterior approach. AP, anterior-posterior.*

does not allow for the identification of particular drivers explaining the rise in AP arthrodesis cases. Moreover, although trained coders record the data, it is susceptible to human error. In addition, *CPT* codes used to categorize procedures into the "anterior-only," "posterior-only," and "anterior-posterior" approaches do not necessarily reflect the underlying case complexity. Some surgeons or coders may invoke modifier 22 to reflect the increased case complexity, a detail not captured in the ACS-NSQIP files.

CONCLUSION

In the present investigation of trends in utilization of different approaches for lumbar arthrodesis, it was found that there has been a steady increase in the proportion of patients treated with either "anterior-only" or "anterior-posterior" fusions, as contrasted with "posterior-only." Over the same period, there has been a commensurate, significant rise in the wRVUs/h for anterior-posterior fusions and a significant decrease in the wRVUs assigned per hour of operative time for posterior-only fusions. Any causal association between the 2 phenomena cannot be documented via this analysis, and additional investigation into this potential association is merited.

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COMMENTS

The authors of this article found that payment rates (wRVU/hr) for combined anterior-posterior (AP) lumbar fusion increased by 0.48 wRVU/yr. over a 10-year period, while posterior-approach fusion payment rates decreased by 0.13 wRVU/yr, and anterior-approach fusion payment rate remained unchanged. They also found that coincident with the increase in payment rate, the frequency of AP approach increased from 7.5% to 15% (12% of all of cases), while posterior fusion frequency dropped from 79% to 60% (66% of all cases), as the payment rate dropped.

The question, of course, is whether money motivated the increase in combined AP approach. The technical reasons proposed for the shift can be summarized as more reliable and effective fusion constructs, better surgical techniques and perioperative management, increasing familiarity with the approach, and perhaps fewer complications. However, a database and statistical analysis cannot answer the question of financial motive. The same question may be (and has been) asked about the steadily increasing total numbers of lumbar fusions since 1993. Is it better surgical instrumentation and technique? Better long-term outcomes? Wider surgeon familiarity with innovative techniques? Medical device industry encouragement? Change in residency training and addition of spine fellowships? Or does revenue, consciously or unconsciously, drive at least some of the surgical decision? Professional ethic demands surgeon freedom from profit motive. But motive is not a data point and cannot be measured. Surgeons must frankly examine and recognize their own motives; no one else can.

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