RESEARCH ARTICLE

Effects of Standardized Pricing for Distal Radius Implants

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Abstract

Objectives: Critical evaluation of implant costs may help mitigate the cost of orthopedic care. In an effort to decrease the financial burden of operative fixation for fractures of the distal radius, a standardized shelf price was established by a large orthopedic practice for all distal radius implants. We hypothesized that by negotiating a fixed reduced cost, total number of screws, number of locking screws, and number of wasted screws would be unchanged and overall implant utilization would not change.

Methods: This was a retrospective analysis of the effect implant price standardization had on the operative care of distal radius fractures at a single outpatient urban surgical center. The total number of screws, as well as the number discarded during each procedure was reviewed. We analyzed the financials three months before and three months following price standardization. We surveyed the ten fellowship trained hand surgeons affected by the change regarding differences in operating procedure and perceived changes in the attendance and utility of the manufacturer's representative.

Results: We reviewed 30 distal radius open reduction internal fixations three months before and 28 cases three months following shelf price implementation. On average, there was a 32% reduction in total implant costs after price standardization. No statistically significant difference in any clinical variables were noted. Negligible change was noted in the surgeon experience in representative availability and surgery-related attributes on the survey. 20% of surgeons switched implants due to the cost restrictions.

Conclusion: Despite a set price for distal radius implants, there was no significant difference in the number of screws utilized or discarded after price standardization. Additionally, despite a 32% reduction in cost, the level of representative attendance and utility were similar before and after the change. Surgeons are willing to be flexible in implant choices based on a cost restriction model.

Level of evidence: III

Keywords: Distal radius, Fracture, Implant, Shelf pricing, Standardized pricing

Introduction

Implant costs in orthopaedic surgery are one of the largest components of cost incurred during the surgical global period, with some authors suggesting that almost 90% of the total cost of care is implant related.[1,2] Despite these costs, many surgeons remain uninformed regarding the pricing of the implants they use.[3] Critical evaluation of costs and implant selection may help to mitigate those expenses while maintaining appropriate care for the patient. Shelf pricing or price standardization has been established with success for other large joint arthroplasty implants to lower the cost of orthopaedic care.[4] Although total joint replacement devices represent a large fraction of health care costs in comparison to other orthopaedic implants, applying the same approach to other areas in orthopaedics may lead to additional savings.

In an effort to decrease the financial burden arising from

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plates and screws used to fix fractures of the distal radius, a standard 'shelf price' was established by our orthopaedic practice for commonly used distal radius implants. The purpose of this study is to evaluate the financial and clinical impact of this purchasing strategy. Importantly, the fixed pricing strategy included both the plate and the accompanying screws, as potential savings from standardizing the price for plates alone could be negated if, for example, the price of screws were to drastically increase after implementation of the contract.[5] We hypothesized that as a result of negotiating a fixed reduced cost, overall expenses would be driven lower without affecting operative decisions such as the type and number of implants utilized. A secondary hypothesis was that the level of representative attendance and availability would decrease due to the financial impact on the implant company margins.

Materials and Methods

Institutional Review Board permission was obtained prior to initiating this study. Standardized pricing was established for plates and screws used in the operative treatment of distal radius fractures. Our practice is a regional orthopaedic surgical group with ten fellowship trained hand surgeons and interest ownership in three outpatient surgical centers and two specialty hospitals. After agreement by all physicians in the group, a contractual agreement was drawn between the physician owned facilities and implant vendors that wished to have their devices used in those facilities. At the time of implementation, a total of 13 implant vendors were used in the facilities. In the contract, a fixed price for fixed and variable angle volar plates and an unlimited number of screws per case was established. The price point ($1,250 USD) was selected based on the lowest cost implant at the time the agreement was established. Only plates with three and four screw holes in the stem were included in the agreement, and specialty plates such as metadiaphyseal plates, were not part of the agreement.

The following variables were obtained from the center's surgical records and implant logs for three months before (October – December 2015) and three months after (January – March 2016) the pricing agreement went into effect: (1) Number of surgical procedures; (2) Total number of screws implanted (locking vs. cortical); (3) Number of discarded screws; (4) Average cost of the procedure per case; and (5) Implant manufacturer. In addition, the total cost difference before and after the agreement was calculated. Finally, in order to assess the clinical impact of this change, ten hand surgeons in the practice were administered a nine-question survey regarding changes in operating procedure and perceived changes in the attendance and utility of the manufacturer's representative. Each survey question had five answer selections on a Likert scale of one - five with one being Strongly Disagree and five being Strongly Agree [Table 1].

A two-sample T test was used to compare the results for differences (Microsoft Excel, Tacoma WA). A p-value of less than 0.05 was considered statistically significant.

Table 1. Surgeon Survey

Please answer the following questions regarding cases of ***DISTAL RADIUS ORIF***

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
Compared to 2015, I have noticed a change in the surgical representative's level of attendance in cases this year	○	○	○	○	○
The surgical representative has played a smaller role this year compared to last year	○	○	○	○	○
I have been more frustrated by the surgical representative this year compared to last year	○	○	○	○	○
My surgical representative has changed since 2015	Yes		No		
If yes to the above, my surgical representative is less experienced	○	○	○	○	○
I have altered my technique of Distal Radius ORIF since there is no additional expense for using extra screws	○	○	○	○	○
I used more screws this year to date than over the same time frame last year	○	○	○	○	○
I less seldom use specialty plates (not in the bundled shelf pricing plan) this year	○	○	○	○	○
I have changed the distal radius plate system I use due to the self pricing agreement	Yes		No		

Results

12 of the 13 vendors which had been in use agreed to the new pricing arrangement. In the three-month period prior to implant price standardization, 30 patients underwent operative distal radius fixation; in the three months following implementation, 28 patients underwent surgery. The differences in hardware utilization before and after the implementation of the pricing structure are as follows (before vs. after): (1) Average number of screws per case (9.2

vs. 8.6); (2) Average number of locking screws per case (5.9 vs. 5.7); Average number of discarded screws per case (0.6 vs. 0.2). None of these differences were statistically significant (P>0.05).

The average price per surgical procedure was $1,849 USD (range $1,340 to $3,452) prior to the change. After the shelf price implementation, the average price was $1,250 USD as expected. This represented an average price difference per case of $599 USD, a 32% reduction from the pre-implementation cost. This difference was statistically significant (P < 0.0001).

The results of the surgeons' survey are given in [Table 2]. Two of the surgeons changed their implant of choice as a result of this change. All of the surgeons strongly disagreed that the change had any substantial change in their practice, level of comfort, and outcomes.

Table 2. Hand surgeons' survey responses

SURVEY QUESTION	AVERAGE SCORE RESPONSE
Compared to 2015, I have noticed a change in the surgical representative's level of attendance in cases this year	1.8
The surgical representative has played a smaller role this year compared to last year	2.1
I have been more frustrated by the surgical representative this year compared to last year	1.7
My surgical representative has changed since 2015:	No: 9 Yes: 1
If yes to the above, my surgical representative is less experienced:	3
I have altered my technique of Distal Radius ORIF since there is no additional expense for using extra screws	1
I used more screws this year to date than over the same time frame last year	1
I less seldom use specialty plates (not in the bundled shelf pricing plan) this year	2
I have changed the distal radius plate system because of the shelf pricing agreement	No: 8 Yes: 2

Discussion

Increased attention has been given to cost-effectiveness and the economics of surgical care. Brauer et al. published a systematic review in 2007 evaluating the current state of the orthopaedics literature in regard to optimizing cost effectiveness.[6] They identified 62 studies discussing ratios of cost to life years (LY) or quality-adjusted life years (QALY) gained. The authors were concerned with the paucity of economic analyses in orthopaedics and challenged the quality of these studies, citing "inconsistent methodological approaches" and "lack of transparency." Daigle et al. published a systematic review in 2012 reviewing cost effectiveness for total joint arthroplasty.[7] They evaluated 13 studies published between 2006 and 2012 selecting only high-quality papers included in the Cost-Effectiveness Analysis Registry. Kuye et al. similarly published a systematic review of the literature for economic analyses in shoulder pathology and found a paucity of material with half (17/32) of all cost effectiveness analyses published in the five years prior.[8] It is apparent that the need for cost-effectiveness literature is recognized by the orthopaedic community and progress is being made to build a foundation of data for efficiency optimization.

The total cost of surgical treatment for distal radius fractures vary slightly based on many factors including, but not limited to, the costs of anesthesia, hardware, operating room, and postoperative care. Mather et al. found the total costs to be $5,220 and $7,640 for ambulatory and inpatient surgery respectively, with the difference largely due to operating room cost. The cost of hardware was found to exceed $1,900 for volar plating.[9] Bruce et al. also analyzed the costs of distal radius fracture treatment and found the overall surgical costs to be $5,228 on average.[10] With roughly 640,000 radius and/or ulna fractures in the United States per year, according to Chung et al., the costs associated with distal radius fracture treatment have a significant impact on overall healthcare costs. Furthermore, hardware accounts for roughly 25-40% of the overall cost and therefore represents a significant cost-saving opportunity.[11]

The goal of this study was to examine the impact of price negotiation and bargaining power on resource utilization in the operating room as well as to understand the effect a negotiated price had on implant representative behavior. In our study, we found that there was no significant change in implant utilization by way of number of screws used, wasted or type of screw. This means that surgeons did not put more screws or more locking vs. non-locking screws just because the price included them. We also found that there was little turnover in the surgical representative and few changes in implant selection after prices were negotiated. Additionally, surgical behavior was no different before and after the implementation date.

This study also demonstrates the bargaining power in the hands of surgeons and surgical practices. Two out of the ten surgeons were not able to use the implant system they had been accustomed to in our group (20%) and willingly changed companies that were able to meet the lower price threshold. Despite small differences, most implants demonstrate similar attributes, surgical options and clinical benefits. This is realized when value is added to cost savings

especially in a pay for service and bundle payment model and these factors become prominent. It is important to recognize that this payment model is not instituted in our practice and there were no direct or indirect benefits, payouts, savings transferred, or other significant conflicts of interest regarding the shelf pricing. However, we postulate that the effects observed in the paper would be more substantial if cost savings were transferred to the surgeons or facility as in a bundle payment system.

Limitations of this study include cohort size. A larger group of patients analyzed before and after the pricing agreement may show differences in implant utilization that our study could not detect. Additionally, our study was a retrospective study designed to evaluate differences in implant utilization over two time periods. Third, our study overlooks the ability of any practice to engage in standardized shelf pricing. Larger practices and hospital groups are more readily able to bargain with implant providers for reduced cost in implants. Given a multitude of competitive implant providers, the threat of losing a large buyer is compelling to provide discounted implant costs to those buyers. It is uncertain, however, what impact this may have on smaller practices and whether the costs were transferred to other clients or hospital systems of the implant companies. A larger study involving multiple practices would better demonstrate the effect that standardized price agreements have on the current industry model as well as the overall delivery of care. Fourth, the physicians involved in this study have ownership interest in the surgical facilities evaluated, and therefore there is the possibility of bias given this conflict of interest is possible. Finally, although large, our practice represents only a regional sampling of the continental United States and therefore the results may not be applicable to other regions.

Conclusion

In conclusion, despite a set price for distal radius implants, we found that there was no significant difference in the number of screws utilized or wasted after the standardized shelf price was established. Additionally, despite a reduction in cost, the surgeon's perspectives on outcomes, facility of use, and level of representative attendance and utility was similar before and after the change.

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References

1. Meyers SJ, Reuben JD, Cox DD, Watson M. Inpatient cost of primary total joint arthroplasty. J Arthroplasty. 1996;11(3):281-285. doi:10.1016/s0883-5403(96)80079-9.
2. Robinson JC, Pozen A, Tseng S, Bozic KJ. Variability in costs associated with total hip and knee replacement implants. J Bone Joint Surg Am. 2012;94(18):1693-1698. doi:10.2106/JBJS.K.00355.
3. Okike K, O'Toole RV, Pollak AN, et al. Survey finds few orthopedic surgeons know the costs of the devices they implant. Health Aff (Millwood). 2014;33(1):103-109. doi:10.1377/hlthaff.2013.0453.
4. Bosco JA, Alvarado CM, Slover JD, Iorio R, Hutzler LH. Decreasing total joint implant costs and physician specific cost variation through negotiation. J Arthroplasty. 2014;29(4):678-680. doi:10.1016/j.arth.2013.09.016.
5. Beredjiklian PK. Shelf Pricing for Distal Radius Fracture Implants. Clin Orthop Relat Res. 2017;475(3):595-596. doi:10.1007/s11999-016-5165-9.
6. Brauer CA, Neumann PJ, Rosen AB. Trends in cost effectiveness analyses in orthopaedic surgery. Clin Orthop Relat Res.

2007;457:42-48. doi:10.1097/BLO.0b013e31803372c9.
7. Daigle ME, Weinstein AM, Katz JN, Losina E. The cost-effectiveness of total joint arthroplasty: a systematic review of published literature. Best Pract Res Clin Rheumatol. 2012;26(5):649-658. doi:10.1016/j.berh.2012.07.013.
8. Kuye IO, Jain NB, Warner L, Herndon JH, Warner JJ. Economic evaluations in shoulder pathologies: a systematic review of the literature. J Shoulder Elbow Surg. 2012;21(3):367-375. doi:10.1016/j.jse.2011.05.019.
9. Mather RC 3rd, Wysocki RW, Mack Aldridge J 3rd, Pietrobon R, Nunley JA. Effect of facility on the operative costs of distal radius fractures. J Hand Surg Am. 2011;36(7):1142-1148. doi:10.1016/j.jhsa.2011.03.042.
10. Bruce KK, Merenstein DJ, Narvaez MV, et al. Lack of Agreement on Distal Radius Fracture Treatment. J Am Board Fam Med. 2016;29(2):218-225. doi:10.3122/jabfm.2016.02.150233.
11. Chung KC, Spilson SV. The frequency and epidemiology of hand and forearm fractures in the United States. J Hand Surg Am. 2001;26(5):908-915. doi:10.1053/jhsu.2001.26322.