Cost Estimates of Biologic Implants Among Orthopedic Surgeons

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Abstract

The use and development of biologic implants such as autogenous bone grafts and bone morphogenetic proteins (BMPs) remain on the rise in orthopedic surgery. Apart from the differences in efficacies seen between the different methods, there is also a difference in the cost associated with each.

We generated a questionnaire inquiring about current use of osteobiologics and cost perceptions, and distributed it to 30 orthopedic surgeons. When answers were compared to operating room pricing data from each institution, surgeons grossly over- and underestimated the costs associated with each of the osteobiologics in the questionnaire. More than 25% of those questioned did not know the cost of the osteobiologics they had used in the last 3 months. Furthermore, none of the participating institutions had a committee with physician participation concerning the use of these techniques.

As the use and cost of osteobiologics by orthopedic surgeons continues to increase, so should the importance of educating those surgeons on the financial outcomes so as to assuage extraneous and unnecessary economic ramifications.

Biologic implants, defined as bioabsorbable or degradable synthetic proteins and inorganic substances that enhance healing, are increasingly being employed in orthopedic procedures.[1] As their usage increased, cost-control practices have somewhat fallen behind, given the novelty of the implants and lack of comparable alternatives amongst different vendors. Additionally, it is hypothesized that surgeons may have an inaccurate notion of relative costs related to these implants. At present, the manner in which these products are used and their associated cost-perceptions amongst surgeons has not been well studied.

The purpose of this study was to better define the usage patterns of biologic implants by a diverse group of orthopedic surgeons. In addition, by comparing the surgeon-perceived cost with the true cost of the product, we hoped to create a more complete picture of shortcomings to cost-control practices.

Materials and Methods

In May of 2008, a survey developed to review usage patterns of biologic implants, as well as current surgeon perceptions in implant costs, was mailed to 30 practicing orthopedic surgeons representing all specialties at 3 teaching hospitals in a specific locality in a defined geographic location in California. The institutions were a university hospital, a national HMO hospital, and a dedicated not-for-profit pediatric hospital; together, these 3 facilities serve a patient population of more than 1 million people. All full-time orthopedic surgeons with dedicated operative room privileges at one of the 3 hospitals were included in this study. Community surgeons with only admitting privileges at the university hospital were not included due to difficulties with regular contact. Additionally, no effort was made to include non-orthopedic surgeons who only occasionally use orthopedic biologic implants (eg, plastic surgeons, otolaryngologists, or neurosurgeons).

Figure 1 shows the printed 2-page questionnaire that was employed. Questions on the questionnaire were designed to target the surgeons' current use of osteobiologics, reasons for choosing certain implants, observed complications, and indications for use. Additionally, surgeons were queried on their perceptions of the hospital cost of 5 commonly used osteobiologic products. Specifically, those surveyed were asked to provide a specific price or indicate, "don't know" for a brand name and volume for each of the 4 products (Synthes DBX, West Chester, Pennsylvania; Medtronic InFUSE, Minneapolis, Minnesota; Osteotech Grafton, Eatontown, New Jersey; H&H/DePuy Platelet-Rich Plasma, Raynham, Massachusetts). Cost perceptions, in turn, were correlated with available operating room supply chain pricing data from each teaching hospital. The prices of the biologics were taken directly from the purchasing orders from each of the 3 hospitals. The hospital administration and operating room administration provided all the available charge sheets and purchasing orders.

Means, medians, ranges, intraquartile ranges, percent differences, and maximum/minimum values for both surgeons' perceived costs and actual costs were calculated. A student's t-test was used to calculate statistical significance, which was set at $P<.05$.

Results

A total of 25 questionnaires were completed and returned

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for a response rate of 83%. Most surgeons returned the questionnaire in the same day it was delivered, and all returned responses were deemed usable.

Table I. Orthopedic Surgery Implant Survey

1. How many times in the last 3 months have you used the following osteobiologics
(a) DBX
(b) Grafton
(c) Platlet-rich plasma (PRP)
(d) inFUSE
2) Compared to the same period one year ago, has your usage of osteobiologics:
(a) Increased
(b) Decreased
(c) Stayed the same
3. What are your top three reasons when choosing implants for your patients?
4. Estimate (to the nearest whole dollar) the cost per unit volume for the following osteobiologics. If you have no predilection indicate so below:
(a) DBX (Synthes) (5 mL): or Do not know
(b) Grafton (Osteotech) (5 mL): or Do not know
(c) Platelet-rich plasma (H&H/DePuy): or Do not know
(d) inFUSE (Medtronic) (Large Pack): or Do not know
5. Using the following scale, how strongly do you believe that there is substantial scientific evidence to warrant continued use of osteobiologics?
1 – Strongly disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly agree

Without question, the most commonly used biologic implant was demineralized bone graft (eg, Grafton, DBX). Forty-eight percent of all respondents indicated that they had used demineralized bone graft approximately 1 to 5 times in the past 3 months. Bone Morphogenetic Proteins (eg, InFUSE, OP-1) was used by 32% of respondents. Twelve percent indicated they had used it 1 to 5 times in the past 3 months, while 8% indicated they had used it more than 10 times in the same time span.

Twenty surgeons (80% of those surveyed) reported that their use of orthobiologics stayed the same over the past 12 months. Only 4 surgeons (16%) indicated that their use had increased. One surgeon (4%) reported a decrease in use of orthobiologics. When asked about their top 3 reasons for using biologic implants, reduced morbidity (80%) was reported as the primary motivation. Other top reasons for using orthobiologics were scientific evidence showing efficacy (52%) and improved clinical outcomes (36%). No surgeon related a complication involving the use of biologic implants in the last 12 months.

A difference in actual versus perceived costs by surgeons was observed. In particular, DBX (Synthes) had a mean surgeon cost estimate of $1087.50 (range, $250-$4500) when actual operating room (OR) pricing on average was $768.67 (range, $576-$880) (**Table I**); a 41.48% overestimation in actual cost to the hospital. Similarly, Grafton (Osteotech) had a mean surgeon cost estimate of $857.14 (range, $200-$2500) when actual OR pricing on average was $587 (range, $575-$600); a 46.02% overestimation in actual cost to the hospital. Platelet-rich plasma (H&H/DePuy) was thought to cost $1850 (range, $250-$5000), but the hospitals actually paid $487 (range, $450-$475); a 279.9% overestimation in actual cost to the hospital. Corticocancellous allograft chips (CCAC) has a mean surgeon cost estimate of $594.00 (range, $100-$300) when actual OR pricing average was $391.00 (**Table II**); a 51.92% overestimation in actual cost to the hospital. Finally a large pack of InFUSE (Medtronic) was perceived as costing $3750 (range, $500-$6000), but actual OR pricing data indicated hospitals paid $5450 (range, $5100-$5408); a 31.19% underestimation in actual cost to the hospital. Twenty-eight percent of surgeons queried reported having no idea what the costs of the biologic implants they

Table II. Surgeon-Perceived Cost and Actual Costs[a]

	Average Surgeon-Perceived Cost	Range Surgeon-Perceived Cost	Actual Cost	Range Actual Cost	Percent Difference From Actual Cost	P-value
DBX	$1087.50	$200-4500	$768.67	$576-880	41.48%	.63
Grafton	$875.14	$200-2500	$587	$575-600	46.02%	.45
PRP	$1850	$250-5000	$487	$450-475	279.90%	.16
CCAC	$594	$100-3000	$391	$358-441	51.92%	.62
InFUSE	$3750	$500-6000	$5450	$5100-5408	31.19%	.15

[a]Average Percent Over-/Underestimation 90.1%

Table III. **Statistical Analyses for all Surgeon Estimates**

	DBX	Grafton	Infuse	CCAC	PRP
Mean	1026.75	629.93	2233.45	638.48	1444.34
Median	600	593.99	3200	475	1300
IQR	1075	500	3200	312.5	1425
Maximum	4500	2500	6000	3000	2300
Minimum	200	200	500	100	250

Abbreviation: IQR, intraquartile range.

had used in the last 3 months were. None of the 3 hospitals had a dedicated committee with physician participation to evaluate biologic implants and determine the formulary. Summaries of perceived costs and OR pricing data are shown in **Table III** and **Figure**.

Discussion

The principle findings of this study demonstrate that the large majority of surgeons surveyed (80%) currently are using orthobiologic products, but the vast majority at present are overestimating or underestimating true costs of the products. In actuality, the average percent under-/overestimation made on the osteobiologics was 90.1%. Additionally, it is apparent that surgeons who more frequently use biologic implants tend to have a better perception of actual costs.

We must be more acutely aware than ever of the potential for waste and unit cost pricing based on available evidence. Data regarding usage of novel and potentially costly implants are especially relevant in this current climate of cost consciousness and discussions of healthcare reform emphasizing comparative efficacy. It is now more important than ever that surgeons be involved in decisions on hospitals' formulary and cost negotiations of biological implants in order to select economical and efficacious biological implants. Such discrepancies in perceived and actual costs may compel institutions to educate their healthcare professionals on costs of biologic implants as well as form a dedicated, structured program involving physician participation for the evaluation of biologic implants being included in the formulary. Furthermore, the formulation of a protocol taking into account the potential for intraoperative and postoperative complications should be taken into account when considering cost. Depending on the patient, the additional perioperative costs of a DBX procedure (eg, complications of the graft site) may end up costing the hospital more despite the modest price of the DBX itself.[2,3] This further emphasizes the potential benefits of educating on the financial outcomes related to biologic implantation. With an improved, more accurate perception of cost, orthopedic surgeons may be able to, in certain situations, more accurately substitute an equivalent, less costly biologic implant to achieve cost savings.

In addition to the raw cost differential between inexpensive interventions (ie, DBM) and more expensive biologic implants (ie, bone morphogenetic protein (InFUSE), perioperative evidence can also be quite telling. In a study of 202 patients who underwent posterolateral lumbar spine fusion procedures involving either DBM or InFUSE, the authors demonstrated that over a 3-month perioperative period, the hospital incurred a higher cost burden in the patients receiving InFUSE rather than DBM.[4] This extrapolates the effects of the decision made in the OR between one operative method and another, to the overall cost to the hospital after the procedure has culminated.

The primary strength of this study was its observational study design that included a diverse, wide-ranging group of subjects in 3 different healthcare institutions in one geographic area. Additionally, the response rate among surgeons was quite good, higher than those typically reported in the literature for similar study designs.[5,6]

Although this study made a strong effort to accurately assess current trends in orthobiologic use and perceptions in cost, it is not without limitations. Like all investigations involv-

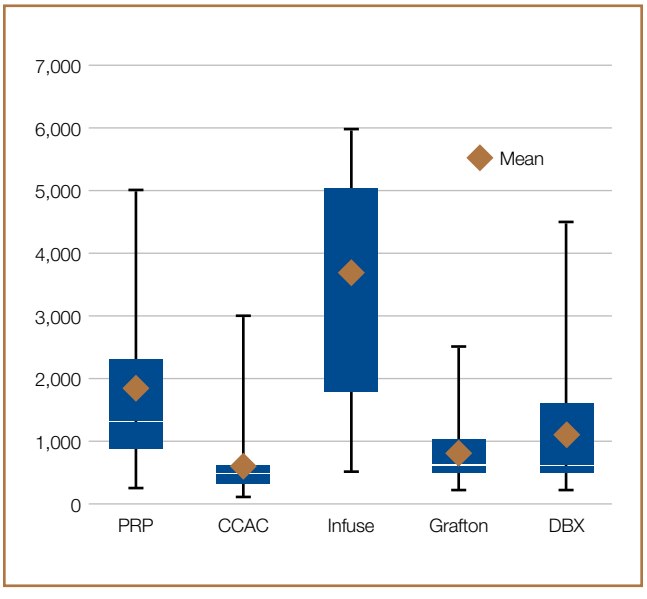

Figure. Differences between perceived costs and actual costs of orthobiologics.

ing surveys, the surgeons queried were susceptible to recall bias when asked to remember how many times they used a product. Additionally, there may also have been selection bias given the relatively small number of surgeons surveyed in one geographic region—although unlikely to be vastly dissimilar, surgeons in other geographic regions may have a different level of cost-consciousness. Selection bias could also arise from the inclusion of subspecialty surgeons who do not typically use biologic implants (eg, hand surgeons, foot & ankle surgeons). Inferences regarding whether the use of one allograft material over another was indicated was not in question. It is reasonable to consider that the use of a more expensive osteobiologic (ie, InFUSE) may be indicated for the patient's benefit, but this study did not choose to look at this factor. Instead it concentrated on the knowledge of cost of the materials to the hospital; so, that when the use of one implant over another was not critically important to patient health a decision could be made with the economical knowledge in addition to the patient's well-being in mind.

Conclusion

In summary, the principle findings of this study suggest that the large majority of surgeons surveyed (80%) are currently using orthobiologic products but are overestimating or underestimating the true costs of the products. In the current healthcare climate of increasing cost-conscientiousness, comparative efficacy and reform, it is more important than ever that surgeons and healthcare administrators collaborate to make key decisions regarding orthobiologics available in hospital formularies. Data from the current study will hopefully prompt larger, unified multicenter data collection on trends in orthobiologic implant use and cost.

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