Patient Demand Matching Orthopedic Implants

Patient demand matching has been touted as a method for a hospital to reduce implant costs without having to go through an elaborate negotiate and competitive bidding situation with an implant vendor. Simply stated, it means "matching the right implant to the right patient." It recognizes that some implants have been engineered for patients with relatively long life expectancies, and other implants are adequate for patients with relatively low demands and l,ife expectancies. According to the vendors, appropriate matching criteria can save 25-30% which is much more than would be available through most vendor discount arrangements.

Lahey Clinic

Several Patient Demand Matching approaches are reviewed here. This simplest is one based on age which is what the HealthEast used to retrospectively analyze their implant cases (see previous article). At the 1993 AAOS meeting, Dr. William Healy of the Lahey Clinic in Burlington, Massachusetts presented a paper on standardization of total hip implants using an implant and patient classification score (Figure 1). The patient typing score was composed of 5 equally weighted factors: age, weight, expected activity, health, and bone stock. Patient typing scores were assigned to 4 demand categories ranging from Demand I (highest demand) to Demand IV (lowest demand). Implants were also classified into four different categories. According to Healy, if the implant standardization program had been in place in 1991, the hospital would have spent $269,391 for prosthesis instead of $362,612 which they actually spent for a savings of $93,221. Their average cost of prostheses per total hip surgery during 1991 was $3,521; if the system would have been in place the cost would have been $2,615 per procedure.

The elements which are used to calculate the patient typing score are relatively straightforward and are available to the surgeon before the surgery. Since the typing system uses the health status classification developed by the American Society of Anesthesiologists, this has made this subjective evaluation of a patient's health (good, fair, poor, etc.) much easier, since the anesthesiologists need to classify their patients for billing and other purposes. The femoral index is basically a test to determine how strong the bone is—a weaker bone will have a higher femoral index since its inside and outside diameter are about the same and would not have as good an outcome with a high-technology implant.

The selection of the prosthesis is based on matching the number of points assigned to the patient to a table of scores indicating the hip stem and cup best suited for the patient. The highest patient demand level would have 22-30 points, and would theoretically require a cementless (porous) stem and cementless

Figure 1

Lahey Clinic Hip Implant Standardization Program

Patient Typing Score

I. Age

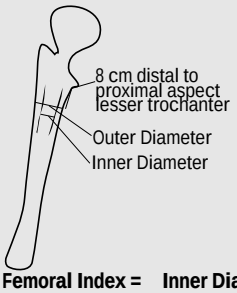
1. >75
2. 70-75
3. 65-69
4. 60-64
5. <60
+ 5 if <55

II. Weight

1. <120 lbs
2. 120-149
3. 150-179
4. 180-200
5. >200 lbs

III. Expected Activity After THA

1. Sedentary
2. Household ambulator
3. Community ambulator
4. No walking limit
5. Sports/heavy limit



IV. Bone stock (Femoral index)

1. ≥ .63
2. .56-.62
3. .49-.55
4. .42-.48
5. ≤.41

V. Health[1]

1. Poor
2. Fair
3. Moderate
4. Good
5. Excellent

Femoral Index = Inner Diameter (Canal) / Outer Diameter (Cortical Bone)

A femoral index of 0.50 ± 0.09 -> osteoarthritis
A femoral index of 0.56 ± 0.09 -> osteoporosis

Femoral Index: cf. Healey , Vigorita, Lane: JBJS April, 1985)

[1]**ASA** (American Society of Anesthesiologists Physical Status Classification.

Poor: (ASA 4) Decompensated diseases/short life expectancy
A patient with an incapacitating disease that is a constant threat to life (heart failure, renal failure).

Fair (ASA 3) Fair control of chronic diseases.
A patient with a severe systemic disease that limits activity (angina, prior heart attack, chronic obstructive pulmonary disease)

Moderate (ASA 2-) Medications controlling chronic diseases.
A patient with a mild systemic disease controled with medication (mild diabetes, controlled hypertension, anemia, chronic bronchitis, morbid obesity)

Good (ASA 2+) No medications. History of chronic medical problems under control. A patient with an inactive, mild, systemic disease (mild diabetes, hypertension, anemia, chronic bronchitis, morbid obesity)

Excellent (ASA 1) No medications. No chronic diseases. A normal healthy patient.

Prosthesis Choice

Demand Category	Score	Cup	Stem
I (High)	22-30	Cementless	Cementless
II	18-21	Cementless	Cemented (forged)
III	12-17	Cementless (age≥70) Cemented (age>71, poly)	Cemented (Cast)
IV (Low)	≤11	Cemented (poly)	Cemented (cast)

cup; the lowest score is for a cast cemented stem and an all polyethylene acetabular cup. For example, the Lahey Clinic uses Howmedica for their hip implants— the cementless stems are PCA stems, which have a list price of about $2,725-$2,975, the forged cemented stems are the Precision stems which are priced at $1,845, and the cast cemented stems are the Premise stems which have a price of $795. The rationale behind using the forged stems for higher demand patients is that the forged cobalt-chromium is a stronger metal than the cast counterpart. This is an interesting differentiation, since DePuy's low demand femoral stem is a forged cobalt-chrome (Response) which costs about $500, and their medium demand stem is a cast cobalt-chrome stem (Target), which costs about $995, which is the opposite of the approach taken with Howmedica's implants.

The implementation of this patient demand matching system was relatively easy at the Lahey Clinic since the physicians and the hospital have a common financial interest in holding costs down. The system was implemented prospectively at the Lahey Clinic on January 1, 1992—each patient is now scored in the operating room just prior to surgery by the attending surgeon, and the implant is selected based on the criteria outlined. According to Healy, the program "has the potential to achieve cost reduction in the hospital cost of total hip arthroplasty without reducing the benefit of THA surgery to patients." Healy indicates that a similar typing system is under development for knee implants as well.

MCCAP

The Minnesota Clinical Comparison and Assessment Project has published "Guidelines and Recommendations for Total Hip Replacement". The MCCAP is a project of the Healthcare Education and Research Foundation (HERF) of St. Paul, Minnesota. HERF is largely supported by Minnesota hospitals in various clinical research projects, one of which is the guidelines for Total Hip replacement. While the original guidelines have been designed more for indications for hip surgery in general, they provide recommendations for primary cemented total hip arthroplasty, cementless total hip replacement, cemented femoral with bipolar, and cementless bipolar. A Summer/Fall 1992 announcement by the Elective Surgery Algorithm Project (ESAP) indicates that the MCCAP guidelines for hip implants have been selected by the ESAP members to be used in the evaluation of hip implant surgery. ESAP is a collaborative effort of the Utah Peer Review Organization (UPRO), Boston University Medical Center, Queen's University, and the Health Care Financing Administration. Their role is to demonstrate whether clinical data bases describing the experience of Medicare patients could be used to more systematically evaluate and promote quality of care.

Industry Approaches

One of the earliest industry initiatives in patient demand matching was developed by Osteonics, with the Hip System Matrix. (See January, 1992 ONN) This matrix, although out of

Figure 2

MCCAP Guidelines and Recommendations for Total Hip Replacement

Selective Relative Indications

A. Primary Cemented THA or Cemented femur and Coated Acetabulum
- Age ≥ 65
- Severe osteoporosis
- Boney deficiency

B. Cementless Total Hip Replacement
- Age ≤ 65
- Avascular necrosis
- Femoral fracture with arthritis
- Conversion hip surgery

C. Cemented Femoral Component and Bipolar Head
- Age ≥ 65
- Displaced femoral neck fractures
- Avascular nectrosis with normal acetabulum in patients>=65

D. Cementless Femoral Component with Bipolar Head
- Displaced femoral neck fractures in patients with ag e ≤ 65
- Avascular necrosis and femoral neck non-union with normal acetabulum

Source: Health Care Education Research Foundation; St. Paul, Minnesota

Figure 3

Hip Fracture Demand Matching

Hip Fracture Patient Classification and Implant Options

High Demand	Implant System	Costs
Young physiologically Longer life expectancy Active life style Good bone quality Good fracture healing capacity	Compression hip screw Recon nails Cannulated hip screw	Low
Medium Demand		
Mid-age Moderate life style Variable bone quality	Bipolar hip Cemented hip	Highly Variable
Low Demand		
Old Short life expectancy Limited life style Poor bone quality Poor hip fracture healing ability	Bipolar Endoprostheses	Moder- ate/ Low

Source: Presented by Roy Crowninshield, Zimmer, U.S.A. at the 1993 American Academy of Orthopedic Surgeons Meeting.

print, displayed demand levels for femurs and acetabular components, with pictures of the individual components categorized into low, medium, and high demand components. Stryker, the parent company of Osteonics, refers to this matrix in their 1990 annual report. Since that time, almost all of the manufacturers have embraced the concept of low, medium and high demand levels and have developed or are developing the technology to address each of the markets.

An entirely different patient demand matching approach was presented at the AAOS meeting by Roy Crowninshield, Ph.D. who is president of Zimmer, U.S. Operations. At the general forum on hip fracture management, Roy discussed the patient demand alternatives in the management of hip fractures. He described the differences in demand levels of patients more in terms of whether the femoral head could be salvaged. If a patient has a fracture of the femoral head, options include compression hip screws, recon nails, cannulated screws which all maintain the integrity of the femoral head; a second alternative includes bipolar hip implants, and finally, patients may receive endoprostheses. Patients with a high demand for hip function may best be treated by fracture repair. This fracture repair utilizes nail or screw devices and require bone with good fracture healing capacity. At the other extreme, endoprostheses can be used for patients for whom the maintainance of the underlying bone is not clinically important. Finally in the middle are patients who do not have the good bone healing potential required for fracture repair, however, their life expectancy and life style requires a higher level of technology than an endoprosthesis. This group of patients would likely require a bipolar hip with a porous or a cemented stem, or a total hip implant.

Thus patients with the highest hip function demand levels have the least expensive implant components, patients with the lowest demand levels are the second least expensive, and patients in the middle can be the most expensive and have the widest range of options. It should also be stressed that the cost in the management of complications of hip fracture repair will often dwarf the individual expenses for an implant.

Summary

Although the primary purpose of patient demand matching is to improve implant selection based on needs, all can be used to help contain implant costs. Although all of the approaches emphasize the need to look at factors other than patient age, it can be seen that age can have large impact on the type of implant selected with any of the systems. Finally, a key ingredient in patient demand matching is combining an implant selection system with a feedback system, such as described in the first article about HealthEast, to ensure that guidelines are being followed and to report the financial results.