Hemiarthroplasty in Hip Fracture Care
Effects of Surgical Volume on Short-Term Outcome

C. J. Lavarnia, MD

Abstract: In 1992, the Agency of Health Care Administration in Tallahassee, Florida started releasing, as part of the discharge information, the names of the treating physician along with the clinical data. This information was used to assess the effects of volume on the short-term outcome of hemiarthroplasty surgery in hip fracture care as a function of surgeons and hospitals in the state of Florida, during the year 1992. A total of 5,604 cases were available for study. Analysis of the data showed that the average inhospital mortality rate was 4.3%. The average length of stay was 11.2 days. After arbitrarily dividing the doctors into three case volume groups (low, medium, high), results showed that surgeons with a low volume of arthroplasty cases (less than 10 per year) had a statistically significant higher average length of stay and inhospital charges when compared with the other two case volume groups. Key words: hemiarthroplasty, volume, outcome quality, hip fracture.

The use of mortality and/or morbidity data, as an indicator of the quality of medical care, has steadily gained acceptance over the past 15 years [1–5]. Computerized collection of discharge-specific information in Florida began in the fall of 1988. The data were initially hospital specific and did not identify the individual physician. In 1992, the Agency of Health Care Administration (AHCA) in Tallahassee, Florida, started collecting and releasing the names of the treating physician. Demographic data including age, sex, address, next of kin, diagnostic data (including up to 10 medical diagnoses), and 10 surgical procedures are currently collected. In addition, the charges for each case are tabulated. This information is currently available to the general public and is being utilized by health planners, managed care corporations, utilization review, hospital administrators, finance departments, third-party payers, and other agencies involved in health care.

The volume–outcome relationship was introduced to the health care field by Adams et al. [6]. This group surveyed data from 173 hospitals to identify differences in complication rates for coronary arteriography as they relate to the volume of procedures. They reported significantly lower complication rates in high-volume institutions. Studies have focused specifically on the relationship between volume and outcome in certain diagnoses and surgical procedures within institutions [1–28].

The recent availability of "surgeon-specific" information gives the investigator the ability to assess the effects of the individual practitioner skill on the short-term outcome.

In the current economic environment, and with managed care growing at alarming rates, these surgeon-specific data can become critical to the practices of orthopaedic surgeons.

Our objective was to assess the effects of surgical volume on the short-term outcome of hemiarthroplasty surgery in hip fracture care as a function of the surgeon's volume.
Materials and Methods

Discharge information is collected on every inpatient case in all the hospitals in the state of Florida (with the exception of free-standing psychiatric, rehabilitation, and state-operated hospitals). These data are collected from each chart upon patient discharge by trained nonclinical personnel ("coders"). This information is submitted quarterly by all hospitals to the AHCA. In order for a hospital to be accredited by the Joint Commission, it must report these data on a scheduled basis. The data are audited for gross errors and then made available to interested parties. The identification of individual patients is removed from the data before its release, but the patient's demographic information and the name of his or her surgeon is maintained.

The data available include age, type of insurance, primary and secondary diagnosis, procedure performed, length of stay, physician (identified by name), and hospital charges. Information such as whether the procedure was a left or a right is not available. In addition, up to 10 diagnoses and procedural information, expressed in ICD-9-CM codes and grouped by their respective DRG codes, are contained in each record. No reference is made to case severity, other than the usage of a DRG "cc" code modifier. In certain DRGs, "cc" code modifiers that account for other codiagnoses will yield the hospital higher federal reimbursement. The two formats in which the data are released are the Universal Billing (UB-82) and the uniform Hospital Discharge Data Summary.

The data collected at discharge by the State of Florida with regard to ICD-9 procedural code 81.52, with the ICD-9 codes for hip fractures over a period of 1 year, were analyzed. This encompassed all hemiarthroplasty procedures done for hip fractures. From the mainframe-style tapes provided by the state, the data were converted into PC format and organized in a database by a specialized software package (In-Stat Analyst, Information Management Systems, Miami, FL). The software generated reports that summarized, for specific ICD-9 codes and DRG grouping, the total number of cases, average length of stay, average charges, complication rate, mortality rate, and market share. Mortality rate was calculated as total deaths divided by total number of cases. Mortality rates reported included only in-hospital mortality. The complication rate was calculated as total number of complications, reported as ICD-9 codes starting with "9" and divided by the number of cases. Coded complications included all codes in

| ICD-9 starting with a 9, such as urinary tract infections as well as prosthetic infections. These complications included only inhospital complications. We correlated the number of cases performed by the surgeon or hospital with the average length of stay, average charges, mortality, and complication rate in a period of 1 year. Comorbid conditions and readmissions were not studied.

The data were arbitrarily divided into three case volume groups. The low volume (group \( P_{low} \)) included those doctors with 10 or fewer cases per year, the medium volume (group \( P_{med} \)) included those with more than 10 to 30 cases per year, and the high volume (group \( P_{high} \)) were those doctors with more than 30 cases per year.

Student's t tests were used to analyze the results. The Bonferroni adjustment was used to correct the \( P \) values when multiple comparisons were performed. \( P < .05 \) was considered statistically significant.

Results

A total of 5,604 hemiarthroplasty cases were performed for hip fractures during 1992 in the state of Florida and were available for study. Table 1 summarizes the data for the number of cases, average length of stay, average hospital charges, mortality rate, and complication rate. Analysis of the data for each volume group demonstrated that 85% of the doctors performed fewer than 10 procedures per year (Table 1). A very small number of surgeons (0.7%) performed more than 30 cases per year.

The means for the average length of stay, average charges, complication rate, and mortality rate among the three volume groups were compared for significant differences (Table 2). There was a statistically significant difference in the complication rate (\( P_{low}/P_{high}; \quad P = .002 \)), the average length of stay (\( P_{low}/P_{high}; \quad P = .002 \)), and the average inpatient charges for the three groups. The three groups were compared with the use of Student's t tests.

| Table 1. Descriptive Statistics for Hemiarthroplasties in 1992 in Florida |
|-----------------------------|-------------|--------------|-------------|-------------------|
| No. of Cases                | Average Length of Stay (Days) | Average Charges ($) | Mortality (%) | Complications (%) |
| Mean                        | 5.2         | 11.5         | $23.1K       | 4.3               | 23.1              |
| Standard deviation          | 5.6         | 6.4          | $29.5K       | 15                | 30                |
Table 2. Statistical Comparisons Among the Three Groups

<table>
<thead>
<tr>
<th>Volume group</th>
<th>( P_{\text{low}}/P_{\text{med}} )</th>
<th>( P_{\text{low}}/P_{\text{high}} )</th>
<th>( P_{\text{med}}/P_{\text{high}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average length of stay</td>
<td>.0001</td>
<td>.0020</td>
<td>.0639*</td>
</tr>
<tr>
<td>Complication rate</td>
<td>.5571*</td>
<td>.0015</td>
<td>.0022</td>
</tr>
<tr>
<td>Mortality rate</td>
<td>.0775</td>
<td>.3421*</td>
<td>.9940*</td>
</tr>
<tr>
<td>Average charges</td>
<td>.0088</td>
<td>.0001</td>
<td>.0001</td>
</tr>
</tbody>
</table>

*Not a significant difference.

charges \( (P_{\text{low}}/P_{\text{high}}; P < .0001) \) for surgeons that had less than 10 cases per year and those with more than 30 cases per year.

Discussion

Patient discharge data enabled us to obtain some useful information on a large number of cases. Average length of stay, average charges, mortality rate, and complication rate on all the hemiarthroplasty cases performed in our state were readily available for analysis and comparison. Identifying practice patterns and pathways in hospitals with low complications and mortality, and sharing the information with other hospitals, has been shown to improve outcomes in hospitals performing coronary artery bypass [12]. Hospitals and orthopedists with the lowest mortality rate should be involved in quality improvement programs in their states.

The complication rate of hemiarthroplasty surgery was found to vary widely. At our hospital, anemia and hyponatremia have been coded as complications since 1992. At that point in time, a “for-profit” corporation purchased the institution from a “not-for-profit foundation.” Hip fracture cases in which open reduction internal fixation is performed can be coded as DRG 210 or 211. The occurrence of one complication or the presence of two comorbid conditions gets a DRG 210 converted into DRG 211, which is reimbursed with an additional $2,205.00. The presence of a complication affects the batting average of a surgeon while a comorbid condition improves it. These “economic incentives” to code complications and the lack of training of the coders are extremely disturbing. These complication rates and charges can be utilized by some third-party payers and health maintenance organizations to negotiate and award contracts in capitated care. In addition, extremely busy surgeons often do not check for “cc” codes or complication codes when they sign their “face sheets.” It is imperative that orthopedists participate in the training of the coders in their institution locally and get involved nationally in developing ways to improve the process. Due to the inconsistent reporting of complications and the economic issues behind it, we caution the reader in interpreting any results published regarding complication rates.

A large percentage of doctors (85%) performed less than 10 hemiarthroplasty cases in 1 year. This low-volume group, however, performed over 50% of the cases done in the state during 1992 (Fig. 1).

Although we did not find a statistically significant correlation in mortality rates among the three groups, Figure 2 shows the trend shown by our data. It is clear from the analysis that busier surgeons tend to have a lower mortality rate. Additional reasons that could explain this lower mortality rate include that the high-volume surgeons have a better reputation and get all the patients referred to them, and the facility is better set up for taking care of hip fractures in hospital.

Lavernia et al. [24] recently reported on the effects of volume on the short-term outcome in elective arthroplasty surgery. The average length of stay \( (P < .0001) \) and the mortality rate \( (P < .0001) \) were significantly higher for the hemiarthroplasty cases when compared with the elective total hip arthroplasties. The average charges for the hemiarthroplasty procedures were not statistically different for these two groups.

About 65% of all orthopedists in Florida performed both total hip arthroplasty and hemiarthroplasty procedures. Our data, when compared with the published data on total hip replacement, showed that hemiarthroplasty, although a shorter and tech-

![Fig. 1. Number of hemiarthroplasty cases performed by volume groups.](image-url)
A simple body mass index could be included as part of the "orthopaedic" or "surgical" severity of illness adjustment. Currently, there is no software, algorithm, or study that can account for a technically difficult case. Inclusions of specific orthopaedic factors should be a priority if a thorough analysis is desired. This fact, and the coding issues discussed above, should raise a red flag when interpreting epidemiological data in orthopaedic patients.

Current data collection procedures focus on the economic and short-term aspects of medicine with the diagnoses and long-term outcomes being almost an afterthought. The task of converting, analyzing, and interpreting the content of the data is then left to the inquiring parties.

Practicing physicians that are involved in high-volume, high-cost procedures, such as hemiarthroplasty surgery, must be included in the data collection design process to increase the scientific value and validate the use of these databases.

Late events that occur after discharge, such as a dislocation or a pulmonary emboli, are not considered as complications in the present data collection scheme. Placing too much emphasis on the short-term outcome might force some surgeons to "cut corners" in ways that will affect the long-term outcome. The focus on short-term costs and short-term outcome is extremely dangerous in orthopaedic surgery.

**Conclusion**

1. Some of the information currently collected by federal agencies at patient discharge has many potential positive uses for patients and surgeons.
2. Surgeons with a low volume of hemiarthroplasties have significantly higher average charges and lengths of stay.

**References**


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**Fig. 2.** Number of primary hip and knee arthroplasties for surgeons with low, medium, and high volume of cases.


