

# Cost Containment: A Charge Comparison of Anterior Cruciate Ligament Reconstruction

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**Summary:** Two matched groups of patients who underwent endoscopic anterior cruciate ligament reconstruction using the middle one third of the patellar tendon were retrospectively reviewed to compare hospitalization charges. Group 1 had the procedure performed in the outpatient surgical center owned by our hospital, and group 2 underwent the surgical procedure in the main operating suite of Rush-Presbyterian-St. Luke's Medical Center. The charges of the surgical procedure and their relation to postoperative hospitalization were reviewed. An average charge difference of \$7,390 (range, \$3,679 to \$12,202) was obtained in the outpatient surgical center. A number of surgical and anesthetic techniques are discussed that allow major reductions in charges for anterior cruciate ligament reconstruction and allow outpatient surgery to be performed routinely. **Key Words:** Anterior cruciate ligament reconstruction—Hospital charges.

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Charges for commonly performed elective operations have come under intensive scrutiny as health costs continue to increase. Anterior cruciate ligament (ACL) reconstruction, a procedure that has evolved rapidly over the past decade, will most likely be one of those operations that will be evaluated for its cost-effectiveness.

Orthopaedic surgery has seen a great increase in the use of arthroscopic procedures, and many of these surgical techniques have allowed care to be rendered in outpatient surgical settings. ACL reconstruction, which previously was associated with hospital stays of up to a week, can be performed in an outpatient setting for most patients.<sup>1-4</sup> The purpose of this study is to retrospectively analyze the hospital charges of ACL recon-

struction performed in two different surgical settings. Patients underwent surgery either in a hospital-owned outpatient surgical center (Rush Surgicenter, Ltd.), or in the main operating room of Rush-Presbyterian-St. Luke's Medical Center.

## MATERIALS AND METHODS

This report describes the comparison of patient charges for two different surgical settings used for ACL reconstruction. The billing records of patients who underwent ACL reconstruction during the same period (April 1, 1994 to December 31, 1994) by each of the senior authors were carefully examined. An endoscopic single-incision technique using autogenous bone-tendon-bone central third patellar tendon substitution was used in all patients and has been previously described.<sup>5</sup> Exclusionary criteria included revision ACL reconstruction, allograft ACL reconstruction, and ACL reconstruction using hamstring tendons.

All patients in group 1 (n = 45) underwent their ACL reconstruction in an outpatient surgical center (Rush Surgicenter, Ltd.), which is owned and operated by Rush-Presbyterian-St. Luke's Medical Center. A

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global surgical charge (“fixed fee”) is employed at the outpatient surgical center. All patients in group 1 were operated on by one of the senior authors. Group 2 patients were all operated on by the other senior author in the main operating suite of Rush-Presbyterian-St. Luke’s Medical Center.

Preoperatively, all patients in group 1 were counseled that ACL reconstruction is performed by that surgeon on an outpatient basis only and that postsurgical inpatient hospitalization was unnecessary. Before the beginning of the arthroscopic procedure, the surgical sites, including all portals, the graft harvest site, periosteum of the patella and tibia, and intraarticular space, were injected with a solution of .25% bupivacaine and a 1:200,000 ratio of epinephrine to assist in hemostasis and analgesia. Anesthetic techniques were not under the direct control of the operating surgeon. Most patients underwent general anesthesia (95%) and had primarily narcotic anesthetic technique. During the procedure, all patients received an intramuscular injection of 60 mg Toradol (ketorolac tromethamine; Syntex Laboratories, Inc, Palo Alto, CA), and an additional 30 mg was given intravenously at the conclusion of the procedure. At the conclusion of the endoscopic ACL reconstruction, the surgical sites were reinjected with a solution of .25% bupivacaine and a 1:200,000 ratio of epinephrine. A commercially available cryotherapy device (Breg Polarcare, Carlsbad, CA) was incorporated into the postoperative dressing. All patients were placed into hinged adjustable removable braces (Don Joy Controlled Motion Brace, Carlsbad, CA). After stabilization in the recovery room, patients were discharged to physical therapy for a single session of gait training, early postoperative range of motion exercises, and instruction regarding prone extension hangs. Patients were then discharged to their home. Oral analgesics (hydrocodone) were used for home pain control. No patients required home patient-controlled anesthesia (PCA) devices or home nursing care.

Preoperatively, patients in group 2 ( $n = 29$ ) were counseled that ACL reconstruction is commonly performed on an outpatient basis, but that postoperative hospitalization for pain control or management of postoperative anesthetic complications was an available option. The selection of anesthetic techniques for group 2 patients was at the discretion of the attending anesthesia staff, and all patients underwent general anesthesia. Identical preoperative and postoperative injection techniques of bupivacaine and epinephrine were used. Ketorolac was administered parenterally to all patients. A cryotherapy device was not routinely used, and immobilization was provided with a knee

immobilizer. Postoperative pain control for group 2 patients was accomplished by a variety of techniques, including parenteral analgesics and PCA pumps (14 of 29 [48%] patients). Antiemetics were administered by parenteral route as necessary. Patients in group 2 who required postoperative hospitalization also received continuous passive motion devices at the discretion of the surgeon (8 of 29 [27%] patients). Twice-daily physical therapy during hospitalization was prescribed.

A retrospective analysis of the patients’ hospital charges was performed by extracting data from the billing files of the academic institution. Total hospital charges were analyzed with respect to operating room charges, hospitalization charges, charges associated with orthoses, and physical therapy charges. Total hospital charges included all charges from the time of admission to the time of discharge, excluding surgeon and anesthesiologist professional charges. Surgeon’s fees were excluded from the study because they are identical for both surgeons. Anesthesiology services were provided for both groups by the same anesthesiology practice and did not differ between groups.

An SPSS statistics software package (SPSS Inc, Chicago, IL) was used to perform a nonparametric Mann-Whitney  $U$ -Wilcoxon analysis of variance. Comparisons were performed between populations within group 2, and also between matched populations in group 1 and group 2. Statistical significance was established at  $P < .05$ .

## RESULTS

### Group 1

The outpatient surgical center uses a single global billing fee for ACL reconstructions. This global fee is a single “flat rate” for all ACL reconstructions of duration less than 4 hours and includes charges for use of preoperative holding rooms, operating room and staff, equipment, instruments, arthroscopy equipment, implants, fluids, medications, and anesthesia technical charges. It does not include surgeon and anesthesiologist professional fees or charges for immobilization devices. All charges for patients in group 1 were identical.

In addition to the global fee (\$3,000), patients in group 1 were also charged for a postoperative brace (\$400), a commercial cryotherapy unit (\$330), and a single session of postoperative physical therapy (\$125). The total hospital charge for each outpatient ACL reconstruction in the surgical center was \$3,855 (Table 1).

**TABLE 1.** Comparison of Total Hospital Charges

	Total Charges Per Patient
Group 1	\$3,855
Group 2	
Mean	\$11,245
Outpatient	\$8,815
1-Day stay	\$12,040
2-Day stay	\$13,503

### Group 2

Mean hospital charges for group 2 patients were \$11,245 (range, \$7,534 to \$16,057). Those procedures performed as outpatients ( $n = 8$ ) had mean charges of \$8,815 (range, \$7,534 to \$11,583). Overnight stay patients ( $n = 18$ ) had mean charges of \$12,040 (range, \$9,714 to \$16,057). Two-day stay patients ( $n = 3$ ) averaged \$13,503 (range, \$12,415 to \$14,202) (Table 1). The mean hospital stay for group 2 was 0.83 days (range, 0 to 2 days). Hospital room charges were \$769 per day. The average charge for a knee immobilizer was \$253. Charges for continuous passive motion machines and physical therapy averaged \$448 and \$242 per day, respectively, for those patients who were prescribed those services. The charges for PCA pumps averaged \$306 per day.

The difference in charges between group 2 outpatients and group 2 overnight stays averaged \$3,225. This difference was statistically significant ( $P < .001$ ). A comparison of group 2 overnight stays and group 2 2-day stays showed a difference of \$1,463. This was not statistically significant ( $P = .07$ ).

### Matched Comparison (Outpatient Surgery)

A direct comparison of group 1 with the outpatient procedures in group 2 showed a mean charge difference of \$4,960 (range, \$3,679 to \$7,728). This difference was statistically significant ( $P < .001$ ).

### Complications

There were no short-term complications in this series in either group. No patient in either group required readmission for pain control or other postoperative or postanesthetic complications, such as nausea or urinary retention. A single patient in group 1 (2%) required a secondary operative procedure for a mild symptomatic knee flexion contracture.

## DISCUSSION

As financial considerations of health care delivery become more prominent in our society, orthopaedic

surgeons are coming under increasing pressures to decrease the length of hospital stay after ACL reconstruction. A gradual trend toward outpatient surgery, as well as "23-hour surgical units," has evolved in the face of rising concerns over health care costs. There is a clear correlation between decreased hospital stay and decreased hospital charges. Nogalski et al.<sup>6</sup> have found that the main factor that was statistically correlated with hospital cost was the length of hospital stay.

Losee et al.<sup>2</sup> reviewed a series of outpatient arthroscopy-assisted ACL reconstructions using autograft central third patellar tendon in 182 patients and semitendinosus in 135 patients.<sup>2</sup> Ten patients had allograft reconstructions. No patient required postoperative intravenous or intramuscular narcotics or readmission for pain relief or wound complications. Other complications were comparable to those of inpatient ACL reconstructions. The investigators estimated that, at their institution, a savings of \$5,900 per patient was achieved using an outpatient protocol.

The findings of our study are consistent with those of Losee et al.<sup>2</sup> and Nogalski et al.<sup>6</sup> A significant correlation was shown between decreased hospital charges and decreased length of stay. Additionally, a significant charge difference between identical outpatient procedures performed in two different surgical settings was demonstrated. The outpatient surgical center is significantly less expensive, with no difference in patient satisfaction or short-term clinical outcome. It is striking to note that the hospitalization charges in 1994 are lower than those of 1989 through 1992,<sup>6</sup> which is reflective of the authors' efforts to contain medical expenses without jeopardizing outcomes. Finally, the patients' perceptions of our transition to an outpatient procedure have been uniformly enthusiastic.

If the orthopaedic surgeon wishes to take advantage of reduced charges that may be available in outpatient settings, one must be committed to consistently performing ACL reconstruction on an outpatient basis. This requires a strong commitment in terms of improved preoperative education (surgeon, nursing, anesthesia), a clear definition of patient expectations, and strong attention to detail by the surgical and anesthetic team in the perioperative period.

Recent advances in anesthesia, notably epidural anesthesia and Diprivan (propofol; Stuart Pharmaceuticals, Wilmington, DE) for general anesthesia, have allowed for easier recovery from anesthesia as well as for fewer anesthetic-related complications.<sup>7</sup> Intramuscular Toradol (ketorolac tromethamine; Syntex Laboratories, Inc, Palo Alto, CA), a nonsteroidal antiinflammatory medication, appears to contribute to reduced

early postoperative discomfort.<sup>1</sup> The prevention of pain in the early postoperative period may greatly diminish pain in the acute postoperative course. A number of pain management protocols are available in the literature.<sup>1,3</sup> These protocols stress the use of adequate doses of oral analgesics in the immediate postoperative period. The patients who have undergone outpatient ACL reconstruction do not routinely need the services of home health nursing or home PCA pump devices.

An integral part of pain control in the perioperative period is the use of injectable local anesthetics. Furia and Zambetti<sup>8</sup> performed a retrospective study of 67 patients, examining the operative time, amount of postoperative pain medicine consumption, length of hospital stay, and incidence of postoperative complications in a group of patients treated with an injection technique consisting of 0.5% bupivacaine and 1:200,000 epinephrine.<sup>8</sup> They found a significant decrease in mean postoperative pain medicine consumption for patients who had been treated with their injection technique. They could find no clinically recognizable complications attributable to the injection technique. The use of injectable bupivacaine and epinephrine intraarticularly and at the graft harvest site before the surgical procedure has benefits for both postoperative analgesia and the decreased use of a tourniquet for adequate visualization. Use of the injection technique allows for graft harvest, diagnostic arthroscopy, and meniscal repair without inflation of the tourniquet. The tourniquet is not routinely inflated, but occasionally it becomes necessary during notchplasty or after drilling of the femoral osseous tunnel. Furia and Zambetti noted a decrease in tourniquet time of 33 minutes in patients who were injected with epinephrine and bupivacaine.<sup>8</sup> The use of the injection technique may directly contribute to a decrease in postoperative pain because of the analgesic effect and may indirectly contribute to a decrease in postoperative pain attributable to a decrease in tourniquet-induced ischemia.

Cryotherapy may be an additional method of reducing postoperative pain. Few studies have evaluated the benefits of cold therapy in the early postoperative period, and the usual difficulties of isolating cryotherapy as the only variable plague this type of study. Cohn et al.,<sup>9</sup> in a randomized study of a cooling unit used postoperatively on ACL reconstructions, found that patients had decreased use of intramuscular pain medication and less subjective pain when the cooling unit was used. Cold therapy may be administered in a number of ways, including ice, cold packs, chemical cold packs, and continuous-flow cooling pads. The senior author (B.R.B.) routinely uses a continuous-flow cool-

ing pad, and most patients subjectively believe that they have less pain with this cryotherapy unit. However, in light of the expense of these commercial continuous-flow cooling pad units, the cost-effectiveness of postoperative cryotherapy must be carefully considered.

The surgical setting in which ACL reconstruction is performed may have a considerable impact on total patient charges. The orthopaedic surgeon may have a choice in selection of surgical settings. As shown in this study, the outpatient surgical center is capable of providing facilities for ACL reconstruction at a global fee that is consistently lower than that in the main surgical suites of the same academic institution. A similar cost differential may or may not exist in other institutions and regions. The surgeon should understand that a "23-hour admission" may in fact be charged at a routine rate for an overnight stay, as is the case at our institution. Outpatient surgical centers have a clear price advantage for routine outpatient procedures. Our main operating room has higher costs because of higher inventory costs, personnel and ancillary services, and other costs associated with maintaining a 24-hour facility. Additionally, cost shifting does not occur at most outpatient centers, because most patients are prescreened for adequacy of third-party reimbursement. It is incumbent on the well-informed orthopaedic surgeon to be aware of the different charges of procedures within various surgical settings. Financial profiling of physicians (the practice of tracking physicians' billing patterns and charges, as well as total charges for a particular procedure) is already in place in many parts of the country. The orthopaedic surgeon who carefully controls all charges for a procedure may be better positioned in a more competitive economic environment.

## SUMMARY

A comparison of hospital charges for endoscopic ACL reconstruction by a single-incision technique showed several results: (1) There is a significant correlation between decreasing hospital charges and decreasing postoperative hospital stays. (2) In matched comparisons of both patient groups, there was a significant difference in charges depending on the surgical setting. Outpatient ACL reconstruction performed in low-cost surgical settings can create considerable cost savings. Consistent performance of ACL reconstruction on an outpatient basis will require significant commitment from the patient, surgeon, and anesthesia teams.

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