LEARNING ARTHROSCOPIC ROTATOR CUFF
Repair Does Not Compromise Patient

James H. Lubowitz, MD
1219-A Gusdorf Rd
Taos, NM 87571–6300
Tel: 505 758 0009
Fax: 505 758 8736
E-mail: jlubowitz@kitcarson.net

Learning arthroscopic rotator cuff repair does not compromise patient outcome: a concise follow-up report.

Purpose: Arthroscopic rotator cuff (RC) repair is reported to have a steep learning curve with rapid decrease in rotator cuff repair time (RCRT) during a surgeon's first 10 cases. Faster surgery may represent learning; however, faster surgery does not represent better surgery. The purpose of this study is to evaluate clinical outcome (rather than RCRT) during the learning phase of arthroscopic RC repair.

Methods: 100 consecutive patients having arthroscopic rotator cuff repair performed by a single surgeon beginning with his first case in private practice described their shoulder self-assessment numerical evaluation (SANE rating) after follow-up of no less than 24 months. Mean SANE ratings for consecutive blocks of ten cases were compared. SANE rating was also analyzed by constructing a best fit linear equation ($y = mx + b$) where m, the slope of the line, illustrates rate of increase in SANE rating as experience is gained (learning).

Results: There were no significant changes in mean SANE rating when comparing consecutive blocks of ten cases ($p = 0.1887$). m, or learning, (rate of increase in SANE rating) equals 0.026.

Discussion: Our results demonstrate that in contrast to RCRT, patient outcome is not compromised during the initial phase of learning arthroscopic RC repair. Learning (improved patient outcome) was observed throughout the study, but statistically significant changes in mean SANE rating were not observed. This finding is corroborated by quantitation of the rate of learning; m of only 0.026 demonstrates that the rate of improvement in outcome with increasing experience is small.

Clinical Relevance: So long as a surgeon is willing to spend the additional time required to complete arthroscopic RC repair during his or her initial cases, patient outcome need not be compromised. This may be reassuring to surgeons contemplating making the transition to arthroscopic rotator cuff repair.

Key Words: Learning; arthroscopic; rotator cuff; repair; outcome.

INTRODUCTION:

With regard to arthroscopic rotator cuff (RC) repair, "Faster surgery does not represent better surgery." [1] Yet, could the opposite also be true? Is it possible that slower surgery might represent worse surgery, specifically surgery resulting in compromised patient outcomes? There is support for this view.

Among the wit and wisdom of surgical aphorisms, it is said, "There are three kinds of surgeons: good fast surgeons, bad fast surgeons, and bad slow surgeons." This suggests that there are no examples of the forth permutation: a good, slow surgeon. Is this wisdom or is this wit? The purpose of this manuscript is to answer this question.

More specifically, our purpose is to determine whether patient outcome is compromised during the learning phase of arthroscopic RC repair, a phase during which operative time, quantitated as rotator cuff repair time (RCRT), takes longer [1]. Our hypothesis is that learning arthroscopic RC repair will not compromise patient outcome.

Arthroscopic rotator cuff repair is demonstrated to have a steep learning curve. Guttmann et al. [1] measured RCRT in 100 consecutive patients having arthroscopic rotator cuff repair performed by a single surgeon beginning with his first case in private practice and concluded that mean RCRT decreased significantly from the first block of ten cases to the second block of ten cases. While learning continued throughout the remainder of the cases, the changes in mean RCRT when comparing other consecutive blocks of ten cases was not statistically significant. The initial phase of learning (as graphically represented by the slope of the learning curve) was steep but rapid (Figure 1).

However, as above, a limitation of Guttmann's investigation is that "Faster surgery may represent learning; however, faster surgery does not represent better surgery." [1] This concise follow-up report addresses the limitation of the original manuscript by evaluating clinical outcome (rather than RCRT) in the original cohort of patients.

METHODS:

The Methods of Guttmann et al. [1] have been reported previously and in detail. After follow-up of no less than 24 months, the original cohort of 100 patients were telephoned by an orthopaedic technologist with no knowledge of the purpose or hypothesis of this investigation and asked to describe their shoulder self-assessment numerical evaluation (SANE rating) where 100 represents a normal shoulder and 0 represents the worst possible shoulder.

Statistical Methods: Statistical analyses were performed using SAS version 9.1.3 (SAS Institute, Cary, NC), and

LEGENDS:

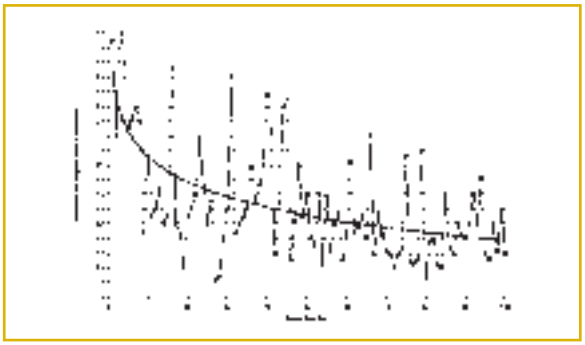

Figure 1: Rotator cuff repair time (in minutes) by case number. The line represents the logarithmic best-fit trend curve.

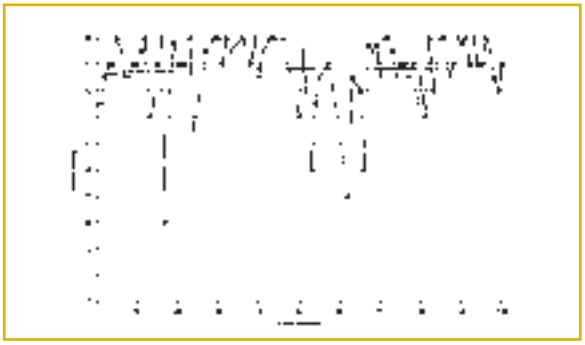

Figure 2: Mean SANE rating by case number. The line represents the logarithmic best-fit trend curve.

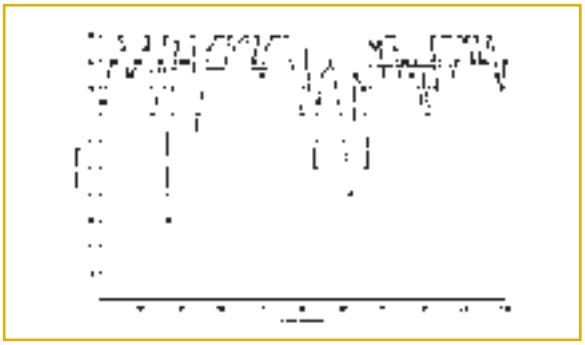

Figure 3: Mean SANE rating by case number. The line represents the linear best-fit trend curve.

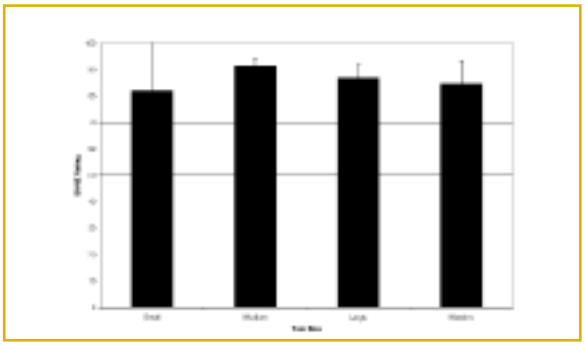

Figure 4: Mean SANE rating by tear size.

Figures were created using Excel (Miscrosoft, Redmond, WA). Descriptive statistics were calculated for the demographic variables of age, gender, and tear size (small, medium, large, massive). Consecutive blocks of ten cases were analyzed for mean SANE rating. Mean SANE ratings were compared using analysis of variance (ANOVA) as were the effects of age, gender, and tear size on SANE rating. P values less than or equal to 0.05 were considered statistically significant. SANE rating was also analyzed by constructing a logarithmic trend curve as well as a best fit linear equation ($y = mx + b$) where x represents case number, y represents SANE rating, and m represents the slope of the line. m, the slope, illustrates the rate of increase in SANE rating as experience is gained (learning).

RESULTS:

At mean follow-up of 50.4 months (range 41-65), 82 patients were located for follow-up (transfer bias = 18%). Mean patient age was 57 years (range 33 to 85 years). There were 54 male and 28 female subjects. There were 5 small tears, 33 medium tears, 26 large tears, and 18 massive tears. Demographic variables, SANE rating, and transfer bias by block number are summarized in Table 1.

Mean SANE rating by case number is illustrated in Figure 2. There were no significant changes in mean SANE rating when comparing the consecutive blocks of ten cases ($p = 0.1887$).

Mean SANE by case number is again illustrated in Figure 3. In this Figure, a best fit linear (as opposed to logarithmic) trend line is applied. The slope (m) of the line equals 0.026 which represents the rate of increase in SANE rating (learning).

In sum, 26% of patients (21/82) reported a SANE rating of 100, 58% of patients (48/82) reported a SANE rating between 80 and 99, and 16% of patients (13/82) reported a SANE rating less than 80 (Table 2).

There is no significant difference in mean SANE rating when cases are stratified by age ($p = 0.2046$). There is no significant difference in mean SANE rating when cases are stratified by gender ($p = 0.1381$). There is no significant difference in mean SANE rating when cases are stratified by tear size ($p = 0.2220$, Figure 4).

DISCUSSION:

The purpose of this study is to determine whether patient outcome is compromised during the learning phase of arthroscopic RC repair, a phase during which RCRT takes longer (1). Our results demonstrate that in contrast to RCRT (Figure 1), patient outcome (SANE rating) is not compromised during the initial phase of learning (Figures 2). Learning (improved patient outcome) was observed throughout the study. However, statistically significant changes in mean SANE rating were not observed when comparing consecutive blocks of ten cases.

This finding is corroborated by evaluation of rate of increase in SANE rating (learning) as quantitatively represented by the slope (m) of the best fit linear trend line derived when mean

LEARNING ARTHROSCOPIC ROTATOR CUFF
Repair Does Not Compromise Patient (cont.)

SANE is graphically analyzed by case number (Figure 3). In this study, the rate of learning was 0.026 (small rate of improvement in outcome with experience). In comparison, the rate of decrease in RCRT (absolute value of m) reported in the initial investigation was 8.75 for the first 10 cases (large rate of improvement in RCRT with experience) and 0.23 for the subsequent 90 cases (moderate rate of improvement in RCRT with experience).[1]

In sum, we interpret these results to indicate that so long as a surgeon is willing to spend the additional time required to complete arthroscopic RC repair during his or her initial cases, patient outcome need not be compromised. This may be reassuring to surgeons contemplating making the transition to arthroscopic rotator cuff repair. In addition, we demonstrate that the rate of increase in SANE rating (learning), while quantitatively small (0.026), is finite. This may also be assuring to surgeons contemplating a career in arthroscopy, because such surgeons may be satisfied to know that with surgical experience, continuous improvement in their patient outcomes may be expected.

We also follow-up on a discussion with regard to tear size. We demonstrate that there is no significant difference in mean SANE rating when cases are stratified by tear size (Figure 4). This is consistent with our initial finding that there is no significant difference in mean RCRT when cases are stratified by tear size. (1)

Limitations of this investigation have been reported previously and in detail. [1] An additional limitation of this investigation is that evaluation of twenty-four month clinical outcome data was not part of the Methods of the original study, (and rather was requested by Arthroscopy journal in review of the original manuscript). Thus, while the original investigation was prospective, the current investigation is retrospective. Pre-operative SANE ratings are not evaluated. We are unable to report change in SANE ratings by case number. Such a report could yield different results. In addition, SANE is a single, patient reported outcome measure; while valid, other or additional outcome measures could yield different results. An additional limitation is that other factors, in addition to increasing arthroscopic experience, could effect outcome. For example, a surgeon's patient selection criteria could change over time. This, too, represents learning, but nevertheless, represents a limitation. In addition, our study is limited by transfer bias of 18%. The outcomes in the patients lost to follow-up, by definition, are unable to be determined; transfer bias of less than 20%, while undesirable, is accepted for twenty-four month follow-up evaluations. Finally, our sub-group analyses (of age, gender, and tear size) must be interpreted with caution; the limited number of study subjects results in a possibility of beta-error, and subgroup analysis was not our primary purpose.

CONCLUSION

Our data supports the hypothesis: learning arthroscopic RC repair did not compromise patient outcome.

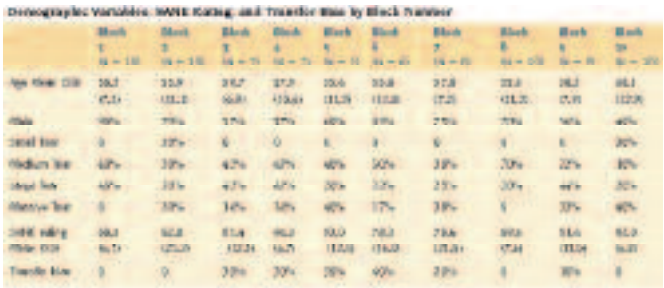

Table 1: Demographic variables, SANE rating, and transfer bias by block number (consecutive blocks of 10 cases). n represents number of cases per block; SD represents standard deviation.

SANE Rating	n	Percentage
100	21/82	26%
80 to 99	48/22	58%
<80	13/82	16%

Table 2: Number (n) and percentage of patients having SANE ratings of 100, SANE ratings from 80 to 99, and SANE ratings of less than 80.

REFERENCES:

1. Guttmann D, Graham R, MacLennan M, Lubowitz JH. Arthroscopic rotator cuff repair: the learning curve. Arthroscopy 2005;21: 394-400.