The Learning Curve for the Latarjet Procedure

A Systematic Review

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**Background:** Anterior shoulder instability, including recurrent instability, is a common problem, particularly in young, active patients and contact athletes. The Latarjet procedure is a common procedure to treat recurrent shoulder instability.

**Purpose:** To identify the reported learning curves associated with the Latarjet procedure and to determine a point on the learning curve after which a surgeon can be considered to have achieved proficiency.

**Study Design:** Systematic review; Level of evidence, 4.

**Methods:** Three online databases (Embase, MEDLINE, PubMed) were systematically searched and screened in duplicate by 2 independent reviewers. The search included results from the inception of each database to January 23, 2017. Data regarding study characteristics, patient demographics, learning curve analyses, and complications were collected. Study quality was assessed in duplicate.

**Results:** Two level 3 studies and 3 level 4 studies of fair methodological quality were included. Overall, 349 patients (350 shoulders) with a mean age of 25.1 years (range, 14-52 years) were included in the final data analysis. Patients were predominantly male (93.7%). After 22 open and 20 to 40 arthroscopic Latarjet procedures, surgeons achieved a level of proficiency as measured by decreased operative time. For open procedures, complication rates and lengths of hospital stay decreased significantly with increased experience (Spearman $r = -0.3$, $P = .009$ and Spearman $r = -0.6$, $P < .0001$, respectively).

**Conclusion:** With experience, surgeons achieved a level of proficiency in performing arthroscopic and open Latarjet procedures, as measured by decreased operative time, length of hospital stay, and complication rate. The most commonly reported difference was operative time, which was significant across all studies. Overall, the Latarjet procedure is a safe procedure with low complication rates, although further research is required to truly characterize this learning curve.

**Keywords:** Latarjet; coracoid process transfer; learning curve; surgeon experience

Anterior shoulder instability is prevalent, most commonly affecting young, athletic patients with high functional demands. Coracoid process transfer, also known as the Latarjet procedure, was first described by Dr Michel Latarjet in 1954. The procedure, which involves the transplantation of a section of the coracoid process flush with or slightly medial to the anterior aspect of the glenoid, continues to be popular for anterior shoulder stabilization with associated glenoid bone loss. More recently, the arthroscopic Latarjet technique has been described, with promising early results. The Latarjet procedure, particularly when performed arthroscopically, is a technically difficult procedure.

In 1979, Luft et al reported a relationship between the number of operative procedures performed by a surgeon and lower mortality rates. This was one of the earliest applications...
of the concept of a “learning curve” in the context of medicine. In a surgical context, the typical learning curve has 4 stages as described by Hopper et al: (1) a rapid ascent in the measured outcome at the onset of training; (2) a zone of diminishing returns, in which further experience only confers marginal improvements in the outcome; (3) a plateau, in which further experience has no additional benefit on the measured outcome; and (4) an age-related decline in the measured outcome. It is worth noting that the phrase “steep learning curve,” while commonly understood to refer to a task or skill that is difficult to master, does not apply in the technical sense. When an outcome is plotted against experience, as described in the classic curve above, the steeper the learning curve, the more easily and quickly the skill is obtained (Figure 1).

Learning curves have important clinical and systemic implications. First, there are clear patient safety issues related to learning curves, a fact highlighted by the United Kingdom General Medical Council Inquiry of a pediatric surgical unit in Bristol. In their analysis of deaths after pediatric cardiac surgery, they concluded that patient safety may be compromised in the early part of the learning curve and that systems should be put in place to mitigate such risks as much as possible. In addition, knowledge of learning curves is an important consideration in residency and fellowship training programs. Finally, in an environment of rapidly growing health care costs, the learning curve of a given procedure is an important consideration in determining its cost-effectiveness and planning for its implementation. Therefore, the purpose of this systematic review was to (1) identify the reported learning curves associated with the Latarjet procedure and (2) determine, if possible, a point on the learning curve after which a surgeon can be considered to have achieved proficiency. We hypothesized that with increased surgeon experience, there would be fewer associated complications, and operative time would be decreased.

METHODS

Search Strategy

Two reviewers conducted a systematic search strategy of the online databases Embase, MEDLINE, and PubMed. The search focused on literature discussing the learning curve of the Latarjet procedure. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines were considered and adhered to in the design and execution of this review. The search was conducted on January 23, 2017, and results from the inception of each database to the search date were considered. Inclusion criteria were as follows: (1) all levels of evidence, (2) studies performed on human patients, (3) operative studies using the Latarjet procedure, and (4) a formal discussion or analysis of the learning curve based on the results of the study. Exclusion criteria were (1) review articles, opinion pieces, editorials, or basic science studies and (2) multiple studies reporting on the same group of patients (only the most recent study was included).

The key terms used in the search included the following, in various combinations: Latarjet, Latarjet-Bristow, shoulder stabilization, learning curve, clinical competence, treatment outcome, experience, motor skills, outcome, intraoperative complications, and postoperative complications. The search strategy is detailed in the Appendix.

Screening of Studies

Titles, abstracts, and full texts of all search results were screened in duplicate by 2 reviewers (S.E., N.S.H.). Also, the reference lists of all included studies were screened for any additional articles. Any disagreements at the title and abstract stages resulted in automatic inclusion for the next stage of screening. Disagreements at the full-text stage were resolved through a discussion and consensus between the reviewers. If an agreement could not be reached, the senior author (M.K.) was consulted.

Quality Assessment of Included Studies

All included studies were assessed for quality through the Methodological Index for Non-Randomized Studies (MINORS). The MINORS is a validated tool consisting of 12 items, each scored 0, 1, or 2. The maximum score is 16 for noncomparative studies and 24 for comparative studies.

Data Abstraction

The same 2 reviewers independently abstracted data from the full texts of included studies. Extracted data were entered into a piloted electronic database (Excel; Microsoft). Collected data included study characteristics, patient demographics, learning curve results, and complications.

Statistical Analysis

The Cohen kappa statistic (κ) was calculated at each stage of the screening process to evaluate the level of interreviewer agreement. Based on the literature, agreement
was categorized a priori as follows: substantial agreement: \( \kappa > 0.60 \); moderate agreement: \( 0.21 \leq \kappa \leq 0.60 \); and slight agreement: \( \kappa < 0.21 \). For MINORS scores, interrater agreement was evaluated by calculating an intraclass correlation coefficient (ICC). Descriptive statistics were calculated where appropriate and are represented with the corresponding measure of variance (eg, SD, 95% CI). We planned a priori to analyze the overall operative time data by dividing all included patients into early and late groups. A Student t test or 1-way analysis of variance was used to compare means between groups as appropriate. Although no literature exists for categorizing MINORS scores, it was decided a priori to categorize the quality of the evidence as follows: very low: \( 0 < \text{MINORS score} < 6 \); low: \( 6 \leq \text{MINORS score} < 10 \); fair: \( 10 \leq \text{MINORS score} \leq 14 \); and good: \( \text{MINORS score} > 14 \).

**RESULTS**

**Study Characteristics**

Five studies met the inclusion and exclusion criteria for this review (Figure 2). The initial search yielded 1160 studies. Of the 5 included studies, published between 2013 and 2016, there was 1 prospective cohort study, 1 retrospective comparative study, and 3 case series (Table 1).

**Study Quality**

There was substantial agreement among reviewers at the title (\( \kappa = 0.71; 95\% \text{ CI, 0.64-0.79} \)), abstract (\( \kappa = 0.72; 95\% \text{ CI, 0.41-1.00} \)), and full-text screening stages (\( \kappa = 1.00; 95\% \text{ CI, 1.00-1.00} \)). Two included studies were level 3
evidence, while the remaining 3 studies were level 4 evidence (Table 1). There was substantial agreement among quality assessment scores using the MINORS criteria (ICC = 0.96; 95% CI, 0.67-1.00). The mean MINORS score for comparative studies (n = 4) was 15.25 ± 1.75 (out of a possible 24), and the mean MINORS score for the single noncomparative study was 6.50 ± 0.71 (out of 16). This indicates that the comparative studies were of good quality, while the noncomparative study was of relatively poor quality.

Patient Demographics

Overall, 370 patients underwent the Latarjet procedure across the included studies, of whom 349 (350 shoulders) were included in the final data analysis (5.7% lost to follow-up).1,4,5,7,14 The mean age of included patients was 25.1 years (range, 14-52 years), and they were predominantly male (93.7%, 327/349 patients). Four studies reported on hand dominance, with the dominant shoulder being affected 58.7% of the time (158/269 shoulders). Only 2 studies reported laterality, in which 52% (66/126) of affected shoulders were the right shoulder. The included studies were conducted in France (2 studies), Canada (1 study), Italy (1 study), and Switzerland (1 study).

Surgical Technique, Learning Curve Groups, and Surgeon Experience

A total of 246 patients (4 studies1,4,5,14) underwent the arthroscopic Latarjet procedure, while 103 patients (2 studies5,7) underwent the open procedure. Only 1 study1 reported data on each consecutive patient and presented a true “learning curve.” Three of the remaining studies divided all patients into 2 or 3 groups of consecutive patients. Specifically, 1 study1 compared the first 42 patients with the remaining patients in a case series of 83 patients, 1 study5 divided a series of 30 patients into the first and second groups of 15 patients each, and 1 study7 divided 28 patients into 2 groups of 10 and 1 group of 8 patients. Finally, 1 study14 compared the first and last 30 patients in a consecutive series of 105 patients. Two studies1,5 commented on the surgeon’s training (“fellowship-trained sports or shoulder surgeon” in 1 study and “shoulder surgeon” in another). Only 1 study14 referred to overall experience, describing the surgeon as a “senior surgeon” (Table 1).

Outcome Measures

All studies used operative times and at least 1 measure of the complication rate to analyze the learning curve. None of the studies specified how operative time was measured (eg, from patient in the room vs incision, etc). Some studies also used other indicators, such as patient-reported outcome measures,4 length of hospital stay,7 and technical markers such as graft positioning.14

Operative Time

All 5 studies identified a statistically significant reduction in mean operative time in the later group as compared to the early group. Specifically, the early groups had a mean operative time of 138.7 minutes (range, 103-183 minutes) versus the late groups, which had a mean operative time of 108.8 minutes (range, 76-139 minutes) (range of P value, .0001-.009).

Learning Curve Analysis of Arthroscopic Studies

In 3 studies that directly compared complications in the early and late groups, no significant differences were found in complications between the early and late groups.1,4,5 The most commonly reported type of complication was graft fracture. One study reported significantly more conversions from arthroscopic to open surgery in the early group compared with the late group (P = .04).5

Two studies found no significant difference in bone block placement or screw angle1,14. One study did report a relative risk of 3 (P = .006) for “unfavorable outcome,” which was defined as a bone block that was “not flushed” and “lateralized.”14 Only 1 study reported on patient-reported

| Study       | Year | Country | Study Design | Level of Evidence | Technique | No. of Patients | Mean Age, y | Grouping of Patients | MINORS Score |
|-------------|------|---------|--------------|-------------------|-----------|-----------------|-------------|----------------------|--------------|
| Athwal et al1 | 2016 | Canada  | Case series  | 4 Arthroscopic     | 83        | 27.8            | Divided in half (42/41) | 15.5       |
| Castricini et al4 | 2013 | Italy   | Case series  | 4 Arthroscopic     | 30        | 32              | Divided in half | 16         |
| Cunningham et al5 | 2016 | Switzerland | Retrospective comparative analysis | 3 Arthroscopic (n = 28) and open (n = 36); learning curve only for arthroscopic | 64 | 26 | 2 groups of 10 patients and 1 group of 8 patients | 16 |
| Dauzere et al7 | 2016 | France  | Case series  | 4 Open             | 68        | 25.5            | Continuous | 6.5         |
| Kany et al14 | 2016 | France  | Prospective cohort study | 3 Arthroscopic | 105 | 20.1 | First 30 vs last 30 | 13.5 |

MINORS, Methodological Index for Non-Randomized Studies.
outcomes and patient satisfaction. Specifically, there were no significant differences in the Rowe score (P = .775) or patient satisfaction (P = .256).4 Table 2 summarizes study findings related to the learning curve.

To estimate a number that may be defined as the required case volume to achieve proficiency in the arthroscopic procedure, operative times were further analyzed. Based on the groupings of patients reported, it was possible to separate all arthroscopic procedures into 2 groups: group 1 (≤42 patients) and group 2 (43-105 patients). Operative times were then compared between these groups using a t test, and group 2 was found to have significantly shorter operative times (mean, 112.4 minutes vs 132.3 minutes, P = .04). Finally, a significant negative correlation was found between experience and length of hospital stay (Spearman ρ = −.6, P < .0001). In contrast, length of coracoid harvesting (P = .186) and bone block positioning (P = .3) were not significantly correlated with experience (Table 2).

Primary data from the Dauzere et al7 study (N = 68 patients) were extracted, and patients were divided into 3 groups and mean operative times compared. The mean operative times were 73.1 ± 28.1, 64.3 ± 17.2, and 58.0 ± 10.2 minutes for the first, second, and third groups, respectively. A 1-way analysis of variance with post hoc Tukey-Kramer analysis revealed that the first group (patients 1-22) was statistically significantly different than the group of the final 22 patients (P = .04) in terms of operative times. Also, when the first 22 patients were compared to the remaining patients using a t test, the mean operative time was also significantly longer in the first 22 patients (P = .03).

**DISCUSSION**

The key finding from this review was that after 22 open and 20 to 40 arthroscopic Latarjet procedures, surgeons achieved a level of proficiency as measured by decreased operative time. This is consistent with previous orthopaedic surgery literature for other procedures, which have often used or reported 30 cases as the cutoff for improvements in the learning curve.10,23,29 The most commonly reported difference was in operative time, which was reported across all studies, including open and arthroscopic studies. Interestingly, 1 study4 divided the procedure into 5 phases (1: joint evaluation and exposure, 2: subscapularis split, 3: coracoid graft harvesting, 4: graft transfer, and 5: graft fixation). This study found that operative time decreased with experience for all phases except graft transfer. Conversion from the arthroscopic to open Latarjet procedure was also reported to be more common in the early group. Interestingly, complication rates, technical markers such as graft position and screw angle, and patient-reported outcomes and satisfaction did not change with increasing experience in performing the procedure.

One aim of this review was to understand and characterize the learning curve for the Latarjet procedure. A learning curve should be conceptualized as a graph, with numbers of cases compared to particular outcome measures of interest (eg, operative time, complications, etc). In this review, however, only 1 study defined the learning curve as such.7 Thus, while it is clear that the Latarjet procedure is a technically challenging procedure and that operative time decreases significantly with experience, we were unable to characterize a true learning curve or identify the number of cases that represent the inflection point based on the currently available evidence.

Operative time is certainly an important measure of proficiency, with implications for cost-effectiveness and systemic resource utilization.28 Previous studies, however, have brought up several concerns about its use as a measure of learning or benefit to patients.6,22 While operative time can provide an indirect measure of skill, it is not an ideal marker of proficiency. For example, while improvement in surgical skill may contribute to reductions in operative time, many other variables play a role in operative time. These can include increasing comfort of the entire surgical team with the procedure and other efficiency gains such as equipment placement.10 Given that no studies reviewed specified how operative time was measured, we were unable to account for this. Also, operative time may not be related to patient outcomes,13 and only 2 studies5,7 included in this review reported clinical outcome measures. Finally, with increasing experience, surgeons often begin to take on more complex cases, which can actually lead to an
increase in operative time. Operative time may also be confounded by the approach or meticulousness of the treating surgeon; a subscapularis split versus takedown and meticulous repair of the capsule and labrum after coracoid fixation may add additional time to the procedure but offer advantages in outcomes and recovery.

Importantly, the arthroscopic Latarjet procedure appears to be safe, with low complication rates even early in the learning curve. It is important to note, however, that this is a complex procedure, and all of the studies included in this review evaluated surgeons who routinely perform arthroscopic shoulder surgery. Although some studies identified a trend toward review evaluated fewer complications in later groups, the differences were universally nonsignificant statistically. Also, technical aspects of the procedure, such as graft placement and screw angle, were not significantly different along the learning curve. Conversion from an arthroscopic to open procedure was found in 1 study to occur significantly more frequently early in the learning curve. Even so, conversion to an open procedure has been shown to be a safe technique, particularly given the long track record of safe open Latarjet procedures.

Future studies should attempt to analyze the learning curve in arthroscopic and open Latarjet procedures using continuous case data to characterize and plot a true learning curve. In addition, while operative time is a useful and easily measured proxy for learning, future studies should be more specific in reporting how operative time was measured (eg, whether it included anesthetic time). Future expert-based trials to assess outcomes of the open versus arthroscopic Latarjet procedure across the learning curve are also needed. Finally, future studies should analyze a wider variety of outcomes to evaluate the success and effectiveness of the Latarjet procedure and to allow more direct comparisons between the arthroscopic and open procedures. Some important measures to consider include patient satisfaction, return-to-work and return-to-sport timelines, and cost-effectiveness.

Strengths and Limitations

This systematic review has numerous strengths, including a broad search strategy and duplicate, independent screening of all articles. The inclusion criteria were designed to be as inclusive as possible, and a manual search was performed to capture any results not included in the initial search strategy. Furthermore, given that less than 6% of patients were lost to follow-up, the risk of selection or attrition bias was minimized. Finally, because of the heterogeneity of the included studies, a meta-analysis was not possible.

The primary limitation of this review was the quantity and quality of evidence available on learning curves in performing the Latarjet procedure. Despite the search strategy employed being intentionally broad, only 5 studies were eligible for inclusion, and the highest level of available evidence was level 3. Also, most studies did not report continuous data, and only 1 used direct patient outcome measures to analyze the learning curve. In addition, we did not break down the variable technical approaches to Latarjet reconstruction, including subscapularis management, standard versus congruent arc configuration, or management of the labrum and capsular tissues. These details may be important to the technical outcomes, but they also present a variable level of challenge that may affect the learning curve and operative times.

CONCLUSION

With experience, surgeons achieved a level of proficiency in performing the arthroscopic and open Latarjet procedures, as measured by decreased operative time, length of hospital stay, and complication rate. The most commonly reported difference was operative time, which was significant across all studies. Overall, the Latarjet procedure is a safe procedure with low complication rates, although further research is required to truly characterize this learning curve.

REFERENCES

1. Athwal GS, Meislin R, Getz C, Weinstein D, Favorito P. Short-term complications of the arthroscopic Latarjet arthroplasty: A North American experience. Arthroscopy. 2016;32:1965-1970.
2. Boileau P, Mercier N, Roussanne Y, Thélu CE, Old J. Arthroscopic Bankart-Bristow-Latarjet procedure: the development and early results of a safe and reproducible technique. Arthroscopy. 2010;26:1434-1450.
3. Bristol Royal Infirmary Inquiry. Care in the operating theatre and the “learning curve,” 2001 Available at: http://webarchive.nationalarchives.gov.uk/20090811143822/http://www.bristol-inquiry.org.uk/final_report/the_report.pdf. Accessed January 2017.
4. Castricini R, De Benedetto M, Orlando N, Rocchi M, Zini R, Pirani P. Arthroscopic Latarjet procedure: analysis of the learning curve. Musculoskelet Surg. 2013;97(suppl 1):93-98.
5. Cunningham G, Benchook S, Kherad O, Lademann A. Comparison of arthroscopic and open Latarjet with a learning curve analysis. Knee Surg Sports Traumatol Arthrosc. 2016;24:540-545.
6. Darzi A, Smith S, Taffinder N. Assessing operative skill. BMJ. 1999;318:878-888.
7. Dauzere F, Faraud A, Lebon J, Faruch M, Mansat P, Bonneville N. Is the Latarjet procedure risky? Analysis of complications and learning curve. Knee Surg Sports Traumatol Arthrosc. 2016;24:557-563.
8. Dumont GD, Fogerty S, Rosso C, Lafosse L. The arthroscopic Latarjet procedure for anterior shoulder instability: 5-year minimum follow-up. Am J Sports Med. 2014;42:2560-2566.
9. Emilio Conforto Gracitelli M, Ferreira Neto A, Benegas E, Angeli Malave ta E, Eiji Sunada E, Henrique Assunção J. Arthroscopic Latarjet procedure: safety evaluation in cadavers. Acta Ortop Bras. 2013;21:139-143.
10. Hoppe DJ, de Sa D, Simunovic N, et al. The learning curve for hip arthroscopy; a systematic review. Arthroscopy. 2014;30:389-397.
11. Hopper AN, Jamison MH, Lewis WG. Learning curves in surgical practice. Postgrad Med J. 2007;83:777-779.
12. Jackson CR, Gibbon KP. “Per ardua ...”: training tomorrow’s surgeons using inter alia lessons from aviation. JR Soc Med. 2006;99:554-558.
13. Jackson TD, Wannaire JJ, Lancaster RT, Rathner DW, Hutter MM. Does speed matter? The impact of operative time on outcome in laparoscopic surgery. Surg Endosc. 2011;25:2288-2295.
14. Kany J, Flamand O, Grimbier J, et al. Arthroscopic Latarjet procedure: is optimal positioning of the bone block and screws possible? A prospective computed tomography scan analysis. J Shoulder Elbow Surg. 2016;25:69-77.
15. Lafosse L, Boyle S. Arthroscopic Latarjet procedure. J Shoulder Elbow Surg. 2010;19(suppl 2):2-12.
16. Lafosse L, Boyle S, Gutierrez-Aramberri M, Shah A, Meller R. Arthroscopic Latarjet procedure. *Orthop Clin North Am*. 2010;41:393-405.

17. Lafosse L, Lejeune E, Bouchard A, Kakuda C, Gobezie R, Kochhar T. The arthroscopic Latarjet procedure for the treatment of anterior shoulder instability. *Arthroscopy*. 2007;23:1242.

18. Latarjet M. Treatment of recurrent dislocation of the shoulder. *Lyon Chir*. 1954;49:994-997.

19. Luft HS, Bunker JP, Enthoven AC. Should operations be regionalized? *N Engl J Med*. 1979;301:1364-1369.

20. McGinn T, Wyer PC, Newman TB, Keitz S, For G. Tips for learners of evidence-based medicine: 3: measures of observer variability (kappa statistic). *CMAJ*. 2004;171:1369-1373.

21. Organisation for Economic Co-operation and Development. *Fiscal Sustainability of Health Systems: Bridging Health and Finance Perspectives*. Paris: OECD Publishing; 2015.

22. Ramsay CR, Grant AM, Wallace SA, Garthwaite PH, Monk AF, Russell IT. Assessment of the learning curve in health technologies: a systematic review. *Int J Technol Assess Health Care*. 2000;16:1095-1108.

23. Rhee S, Konangamparambath S, Haddad F. Hip arthroscopy: the learning curve. *Orthopaedic Proceedings*. 2010;92-B(Suppl 2):309.

24. Ruci V, Duni A, Cake A, Ruci D, Ruci J. Bristow-Latarjet technique: still a very successful surgery for anterior glenohumeral instability. A forty year one clinic experience. *Open Access Maced J Med Sci*. 2015;3:310.

25. Schmid S, Farshad M, Catanzaro S, Gerber C. The Latarjet procedure for the treatment of recurrence of anterior instability of the shoulder after operative repair: a retrospective case series of forty-nine consecutive patients. *J Bone Joint Surg Am*. 2012;94(11):e75.

26. Shamseer L, Moher D, Clarke M. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*. 2015;349:g7647.

27. Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological Index for Non-Randomized Studies (MINORS): development and validation of a new instrument. *ANZ J Surg*. 2003;73:712-716.

28. Tanner S, Sprague S, Jeray K. Users' guide to the orthopaedic literature: what is a cost-effectiveness analysis? *Indian J Orthop*. 2008;42:126-136.

29. Zhang Q, Zhang Q, Guo W, et al. The learning curve for minimally invasive Oxford phase 3 unicompartmental knee arthroplasty: cumulative summation test for learning curve (LC-CUSUM). *J Orthop Surg Res*. 2014;9:81.

### APPENDIX

#### Outline of Systematic Search Strategy

**MEDLINE**

| Search strategy | Embase | PubMed |
|----------------|--------|--------|
| Latarjet       | Latarjet | (((((latarjet) OR latarjet-bristow) OR coracoid process transfer) OR shoulder stabilization)) AND (((((learning curve) OR learning) OR clinical competence) OR treatment outcome) OR experience) OR motor skills) OR outcome) OR fatal outcome) OR outcome assessment) OR intraoperative complications) OR complication) OR postoperative complications) |
| Latarjet-bristol | Latarjet-bristow | Filters: Humans; English |
| Shoulder stabilization | Shoulder stabilization | |
| Learning curve | Learning curve | |
| Learning | Learning | |
| Clinical competence | Clinical competence | |
| Treatment outcome | Treatment outcome | |
| Experience | Experience | |
| Motor skills | Motor skills | |
| Outcome | Outcome | |
| Fatal outcome | Fatal outcome | |
| Outcome assessment | Outcome assessment | |
| Intraoperative complications | Intraoperative complications | |
| Complication | Complication | |
| Postoperative complications | Postoperative complications | |
| 1 OR 2 OR 3 | 1 OR 2 OR 3 | |
| 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 | 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 | |
| 16 AND 17 | 16 AND 17 | |
| Limit 18 to English and humans | Limit 18 to English and humans | |

**No. of articles retrieved**

| MEDLINE | Embase | PubMed |
|---------|--------|--------|
| 251     | 324    | 585    |