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Review Article

Latarjet Classics: An Analysis of The 50 Most-Cited Articles on The Latarjet Procedure

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a Benjamin Gross is currently a medical student at the Icahn School of Medicine at Mount Sinai. His interests include medical education, research, and mentorship.

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Conflicts of Interest Statement for Benjamin Gross

b Dr. Carl Cirino is an accomplished orthopedic surgeon specializing in shoulder and elbow care at the HSS Sports Medicine Institute. He also holds the position of Assistant Professor of Orthopedic Surgery at New York-Presbyterian Hospital and Weill Cornell Medical College. Dr. Cirino's expertise spans the spectrum of shoulder and elbow conditions allowing him to provide comprehensive and ongoing care to his patients. With a wealth of experience in treating athletes of all levels and age groups, he recognizes the significance of helping people of all ages and abilities regain their desired activity level. He currently serves as an assistant team physician for the New York Mets.

In his practice, Dr. Cirino focuses on athletic and traumatic shoulder and elbow injuries as well as degenerative shoulder conditions such as rotator cuff tears and shoulder arthritis. He has a particular interest in throwing injuries of the shoulder and elbow. Focusing on the shoulder and elbow enables Dr. Cirino to offer patients an extensive range of treatment options, from non-surgical modalities to minimally-invasive arthroscopy and complex open reconstructions, depending upon each patient's unique needs.

Before beginning his practice, Dr. Cirino completed a shoulder and elbow fellowship at the Hospital for Special Surgery. He was an orthopedic resident at Mount Sinai Hospital and attended medical school at the University of Connecticut. Prior to committing to a career in medicine, he graduated from Boston College with a degree in business management and finance.

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Conflicts of Interest Statement for Dr. Cirino

c Akiro Duey is a third-year medical student at the Icahn School of Medicine at Mount Sinai. He majored in in mechanical engineering at Northeastern University in Boston where he completed engineering internships at Olympus, Boston Scientific, and Medtronic. His research focuses on orthopaedic conditions of the shoulder and spine. Other academic interests include computational research and medical device innovation.

Conflicts of Interest Statement for Akiro Duey

d Troy Li is a third year medical student at the Icahn School of Medicine. His research interests include quality improvement and outcomes research.

Conflicts of Interest Statement for Troy Li

e Christopher White is a fourth year medical student at the Icahn School of Medicine at Mount Sinai who is currently applying into orthopedic surgery residency.

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h Dr. Dave Shukla is an Assistant Professor of Orthopedic Surgery with subspeciality training in Shoulder and Elbow Surgery. Dr. Shukla completed his undergraduate degree at the University of California Berkeley and medical degree at University College Dublin. His orthopedic surgical training started at the Mayo Clinic where he completed his General Surgery Internship. He then completed a two-year Biomechanics Research Fellowship at Mayo Clinic, focusing on traumatic elbow injuries. He completed Orthopedic Surgery Residency at the Icahn School of Medicine at Mount Sinai in New York, and then returned to the Mayo Clinic for a one-year Subspecialty Fellowship in Adult Reconstruction of the Upper Extremity (Shoulder and Elbow surgery). After fellowship he joined a multi-specialty group in Southern California where he became a partner, and was involved in hospital Quality Control and developed an Enhanced Recovery Protocol for Shoulder Arthroplasty. He has been very active in research and has maintained an interest in advancing the field of shoulder and elbow surgery. He is committed to practicing evidence-based medicine, and is an author on over 50 peer-reviewed publications. He has had 24 presentations at national and international meetings, and serves as a consultant editorial reviewer for four orthopedic journals.

Dr. Shukla is a member of the American Shoulder and Elbow Surgeons, a Fellow of the American Academy of Orthopedic Surgeons and is Board Certified by the American Board of Orthopedic Surgery.

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Purpose: The Latarjet procedure was initially described by Michel Latarjet in 1954 as a treatment for recurrent dislocations of the shoulder. Over the last decade, an arthroscopic approach has emerged as the natural evolution of the open procedure. The purpose of this study was to identify and analyze the fifty most-cited articles related to the Latarjet, analyze the associated characteristics of each article, and to evaluate whether surgeons are currently influenced by primarily higher versus lower-level studies.
Methods: Various Boolean queries were searched on the Clarivate Analytics Web of Science, which yielded final search terms of topics on “latarjet OR latarjet-bristow OR bristow-latarjet OR latarjet-patte or patte-latarjet". Information collected included: author demographics, study type, level of evidence, journal name, number of citations, and publication year.
Results: The top fifty Latarjet articles had 5,319 citations and consisted of 0 level I, 3 level II, 8 level III, 25 level IV and 14 level V studies (date range: 1983 – 2017, median 2012). The most cited article received 454 citations. Authors from France (n = 14, 27%) contributed the most to included papers, followed by the United States (n = 8, 16%).
Conclusions: The most-cited articles on the Latarjet procedure tend to be case series, cohort studies, and expert opinions published primarily by French and American authors between 2000 and 2016. With the recent technical innovation surrounding the Latarjet procedure and glenoid bone-block reconstruction in general, these articles may form the foundation that future higher level-of-evidence studies will build upon in their research.

INTRODUCTION

The Latarjet procedure was initially described by Michel Latarjet in 1954 as a novel treatment for recurrent dislocations of the shoulder (Latarjet 1954). The procedure involves transfer of the coracoid, along with the conjoined tendon, to the anteroinferior surface of the glenoid. It is hypothesized to improve anterior shoulder instability by increasing the bony surface area of the shoulder joint, supplementation of the capsuloligamentous complex with the coracohumeral ligament, and via a “sling-effect” with the conjoined tendon provided an additional anterior restraint to subluxation when in an abducted and externally rotated

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position (Yamamoto, Muraki, An, et al. 2013). Although initially described as a treatment for recurrent instability, the Latarjet procedure is frequently used in both primary and revision settings, demonstrating a significant reduction in instability events (Allain, Goutallier, and Glorion 1998; Yapp, Nicholson, McCallum, et al. 2020; Werthel, Sabatier, Schoch, et al. 2020). Common indications include young, contact athletes with a high risk of recurrence and patients with glenoid bone loss (Allain, Goutallier, and Glorion 1998; Domos, Lunini, and Walch 2018; Giles, Boons, Elkinson, et al. 2013; Hurley, Schwartz, Mojica, et al. 2021; Gilat, Lavoie-Gagne, Haunschild, et al. 2020; Arner et al. 2020).

Numerous techniques have been described since the procedure's inception, with the arthroscopic Latarjet emerging over the last decade as the natural evolution of the classic open Latarjet procedure (Burkhart, De Beer, Barth, et al. 2007; Young et al. 2011; Getz and Joyce 2020; Wong, Friedman, and Garrigues 2020; du Plessis, Dachs, Vrettos, et al. 2018; Lafosse and Boyle 2010; Sharareh et al. 2021; Bhatia, Frank, Ghodadra, et al. 2014). This arthroscopic approach allows for many advantages of the open Latarjet procedure with the additional advantages of minimally invasive techniques (John and Wong 2019). While this technically demanding procedure comes with its own challenges and complications, recent modifications have been made to mitigate these new concerns (Tibone 2016; Moga, Konstantinidis, Coady, et al. 2018; Imai 2021; Ranne and Kainonen 2021).

The large volume of research being published can create difficulty in finding the most influential articles on a given topic. A bibliometric or citation analysis can be used to determine the impact a publication has on a specific topic or field (Cheek, Garnham, and Quan 2006; Garfield 1972; Lefaivre, Shadgan, and O'Brien 2011). In recent years, bibliometric analyses have been published for all shoulder surgeries, shoulder instability, arthroscopy, and Bankart lesions, though not with specific focus on the Latarjet procedure or bone-augmentation in shoulder instability (Namdari, Baldwin, Kovatch, et al. 2012; Bondar, Damodar, Schiller, et al. 2021; Allahabadi, Eftekhari, Feeley, et al. 2021; Moore et al. 2021). However, Allahabadi et al. in their study of Top 50 most-cited shoulder instability articles, found an increasing emphasis on bone-loss and Latarjet procedures during the last 10 years when compared to the cohort as a whole (Allahabadi, Eftekhari, Feeley, et al. 2021). This highlights the growing impact and utilization of the latarjet procedure in orthopedics and the need to best understand the existing research on the topic (Reider 2020; Kukkonen, Elamo, Flinkkilä, et al. 2021).

The purpose of our study was to identify the fifty most cited publications on the Latarjet procedure, as well as the articles' associated characteristics. We hypothesized that year of publication would significantly impact the frequency an article was cited. The secondary purpose was to evaluate the evidence-level of the most influential articles. We anticipated that the majority of the most-cited articles would be of lower level evidence versus Level I or Level II studies. These findings can also highlight the recently-increased interest and controversies around this procedure and identify potential areas of focus for future research, particularly in respect to the types of studies needed.

METHODS

Institutional review board approval was not required because the data in the Clarivate Analytics Web of Science is publicly available. The Clarivate Analytics Web of Science was queried multiple times on December 12th, 2021 to perform this analysis. Numerous boolean combinations were entered into the database until a search-term provided the greatest number of returned articles. We attempted to include reference to relevant modifications on the Latarjet procedure, including by May in 1970 and Patte in 1980, in our search terms (May 1970). The final search-term used was "TOPIC: latarjet OR latarjet-bristow OR bristow-latarjet OR latarjet-patte or patte-latarjet".

Articles returned by the final search-term were sorted based on the total citations per article. Titles and abstracts were reviewed and analyzed to exclude studies that were clearly unrelated to Latarjet. Articles needed to present information on indications, procedural descriptions, techniques, outcomes, or outcomes of Latarjet to be included. Articles that were systematic reviews or briefly mentioned Latarjet were excluded. These inclusion and exclusion criteria were similar to that utilized by other citation analyses (Barbera, Selverian, Courington, et al. 2020). If there was no agreement about whether an article should be included or excluded, the entire article was reviewed by a board-certified shoulder surgeon for the final determination.

Top fifty most-cited Latarjet articles were reviewed (XXX, XXX, and XXX) to collect each article's author names, country of origin, publishing journal, type of article (e.g. biomechanical/cadaveric study, case-control study, cohort study, etc.) year of publication, number of citations, and the level of evidence according to The Journal of Bone and Joint Surgery's published guidelines (Marx, Wilson, and Swiontkowski 2015). Citation density was calculated for each article as the total number of citations divided by years since publication according to Moore et al (Moore et al. 2021). The level of evidence and type of article were independently determined by (XXX, XXX). If a consensus on classification could not be reached, then a third author (XXX) made the final determination.

RESULTS

The final search-term used on the Clarivate Analytics Web of Science returned 921 results. The first 921 articles were reviewed to identify fifty articles that were the most-cited articles relating to Latarjet (Table 1).

There were a total of 5,319 citations (106 citations per article) among the top 50 most-cited Latarjet articles (Table 1). Allain et al., published in 1998, had the most citations with 454 total citations and an average of 19 citations per year. The article with the least number of citations was published in 2011 by Dolan et al. and has been cited 44 times (4 citations per year). The article with the most citations did not have the highest citation density. Rather,

Table 1. The 50 most-cited Latarjet articles.

Rank	Article	Author	No. of Citations	Citation Density*	Purpose/Aim
1	Long-term results of the Latarjet procedure for the treatment of anterior instability of the shoulder (Allain, Goutallier, and Glorion 1998)	Allain et al.	454	18.9	To determine the prevalence of glenohumeral osteoarthrosis and the factors related to its development after the Latarjet procedure.
2	Results of modified latarjet anteroinferior instability reconstruction in patients with and significant bone loss (Burkhart, De Beer, Barth, et al. 2007)	Burkhart et al.	349	23.3	To analyze the results of the modified Latarjet procedure for shoulder instability associated with an inverted-pear glenoid (bone loss of at least 25% of the width of the inferior glenoid) or an engaging Hill-Sachs lesion.
3	The arthroscopic latarjet procedure for the treatment of anterior shoulder instability (Lafosse, Lejeune, Bouchard, et al. 2007)	Lafosse et al.	261	17.4	To report a new surgical technique, the arthroscopic Latarjet procedure.
4	One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: Study I - Clinical results (Hovelius et al. 2004)	Hovelius et al.	205	11.4	To prospectively study the Bristow-Latarjet repair and reports the outcome in 118 shoulders where the patients have been followed up for 15 years.
5	Long-term results of the Latarjet procedure for anterior instability of the shoulder (Mizuno, Denard, Raiss, et al. 2014)	Mizuno et al.	181	22.6	To evaluate the long-term functional outcomes after the Latarjet procedure and to assess the prevalence of and risk factors for glenohumeral arthritis after this procedure.
6	Long-term results with the Bankart and Bristow-Latarjet procedures: Recurrent shoulder instability and arthropathy (Hovelius, Sandström, Rösmark, et al. 2001)	Hovelius et al.	178	8.5	To compare the functional outcome and to determine the prevalence of dislocation arthropathy in 2 groups of patients operated on with either a Bankart stabilization or a Bristow-Latarjet procedure for recur- rent anterior dislocation of the shoulder.
7	One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: Study II - the evolution of dislocation arthropathy (Hovelius, Sandström, and Saebö 2006)	Hovelius et al.	166	10.4	To evaluate the Bristow-Latarjet repair at 2 and 15 years after surgery with respect to arthropathy and to evaluate factors responsible for this development.
8	The effect of capsular repair, bone block healing, and position on the results of the Bristow-Latarjet procedure (study III): long-term follow-up in	Hovelius et al.	159	15.9	To evaluate the results of the May modification of the Bristow-Latarjet procedure ("coracoid in standing position") in 319 shoulders with respect to (1) coracoid healing and position and (2) surgical treatment of the joint capsule.

	319 shoulders (Hovelius, Sandström, Olofsson, et al. 2012)				
9	Open Latarjet procedure for management of bone loss in anterior instability of the glenohumeral joint (Young et al. 2011)	Young et al.	148	13.5	To describe a technique for open Latarjet procedure with numerous modifications from the original, most notably the use of 2 screws instead of 1 to provide stable fixation of the coracoid and a subscapularis-splitting approach.
10	Arthroscopic Bankart-Bristow-Latarjet Procedure: The Development and Early Results of a Safe and Reproducible Technique (Boileau, Mercier, Roussanne, et al. 2010)	Boileau et al.	134	11.2	To evaluate the reproducibility and safety of a novel arthroscopic technique combining a Bristow-Latarjet procedure with a Bankart repair and to report the early clinical and radiologic results.
11	The Open Latarjet Procedure Is More Reliable in Terms of Shoulder Stability Than Arthroscopic Bankart Repair	Bessiere et al.	129	16.1	To compare patients with recurrent posttraumatic anterior shoulder instability treated with arthroscopic Bankart or open Latarjet procedure in terms of (1) frequency and timing of recurrent instability, (2) risk factors for recurrent instability, and (3) patient-reported outcomes.
12	The Stabilizing Mechanism of the Latarjet Procedure A Cadaveric Study (Yamamoto, Muraki, An, et al. 2013)	Yamamoto et al.	126	14.0	To determine the stabilizing mechanisms of the Latarjet procedure using cadaveric models.
13	Normalization of Glenohumeral Articular Contact Pressures After Latarjet or Iliac Crest Bone-Grafting (Ghodadra, Gupta, Romeo, et al. 2010)	Ghodadra et al.	123	10.3	To investigate the alterations in glenohumeral contact pressure associated with the placement and orientation of Latarjet or iliac crest bone graft augmentation and to compare the amount of glenoid bone reconstruction with two coracoid face orientations.
14	Long-Term Restoration of Anterior Shoulder Stability: A Retrospective Analysis of Arthroscopic Bankart Repair Versus Open Latarjet Procedure (Zimmermann, Scheyerer, Farshad, et al. 2016)	Zimmermann et al.	119	19.8	To compare shoulder stability after treatment with the 2 commonly performed procedures, the arthroscopic Bankart soft-tissue repair and the open coracoid transfer according to Latarjet.
15	Bristow-Latarjet and Bankart: a comparative study of shoulder stabilization in 185 shoulders during a seventeen-year follow-up (Hovelius, Vikerfors, Olofsson, et al. 2011)	Hovelius et al.	116	10.6	To analyze patients' self-reported results after a minimum of 13 years for 2 series of shoulder repairs performed in 2 Swedish hospitals, 1 using Bristow-Latarjet and the other using the Bankart repair.
16	Surgical treatment of anterior instability in rugby union players: clinical and radiographic results of the Latarjet-Patte	Neyton et al.	112	11.2	To report the clinical and radiographic results of treatment of post-traumatic anterior recurrent instability with coracoid bone block in rugby players with a minimum 5 years' follow-up.

	procedure with minimum 5-year follow-up (Neyton, Young, Dawidziak, et al. 2012)				
17	The modified Bristow procedure for anterior shoulder instability - 26-year outcomes in naval academy midshipmen (Schroder, Provencher, Mologne, et al. 2006)	Schroder et al.	109	6.8	To assess the long-term outcomes of a modified Bristow procedure and to define the impact of surgery on the active-duty military assignments and subsequent careers of these former United States Naval Academy midshipmen.
18	Coracoid Transposition for Recurrent Anterior Instability of the Shoulder - A 20-Year Follow-Up-Study (Singer, Kirkland, and Emery 1995)	Singer et al.	108	4.0	To report the 20-year results of Bonnin's modification of the Bristow-Latarjet procedure in 14 patients operated on by one surgeon.
19	The Coracoid Transfer for Recurrent Dislocation of the Shoulder - Technical Aspects of the Bristow-Latarjet Procedure (Hovelius, Körner, Lundberg, et al. 1983)	Hovelius et al.	108	2.8	To determine the importance of factors such as healing and position of the transferred coracoid process with regard to the postoperative clinical results.
20	Coracoid graft osteolysis after the Latarjet procedure for anteroinferior shoulder instability: a computed tomography scan study of twenty-six patients (Di Giacomo, Costantini, and de Gasperis 2011)	Di Giacomo et al.	107	9.7	To determine the location and the amount of the coracoid graft osteolysis on 26 patients prospectively followed-up after the Latarjet procedure.
21	The Arthroscopic Latarjet Procedure for Anterior Shoulder Instability 5-Year Minimum Follow-up (Dumont et al. 2014)	Dumont et al.	96	12.0	To evaluate the rate of recurrent instability and patient outcomes a minimum of 5 years after stabilization performed with the arthroscopic Latarjet procedure.
22	Open Shoulder Repair of Osseous Glenoid Defects Biomechanical Effectiveness of the Latarjet Procedure Versus a Contoured Structural Bone Graft (Wellmann, Petersen, Zantop, et al. 2009)	Wellmann et al.	91	7.0	To investigate the stabilizing effects of the Latarjet procedure and a contoured structural bone graft in a systematic biomechanical cadaveric study.
23	Arthroscopic Bristow-Latarjet Combined With Bankart Repair Restores Shoulder Stability in Patients With Glenoid Bone Loss (Boileau, Thélu, Mercier, et al. 2014)	Boileau et al.	89	11.1	To determine whether an arthroscopic Bristow-Latarjet procedure with concomitant Bankart repair (1) restored shoulder stability in this selected subgroup of patients, (2) without decreasing mobility, and (3) allowed patients to return to sports at preinjury level. We also evaluated (4) bone block positioning, healing, and arthritis and (5) risk factors for nonunion and coracoid screw pullout.
24	Complications of the	Gupta et al.	87	12.4	To discuss the various complications

	Latarjet procedure (Gupta et al. 2015)				reported in literature for the Latarjet procedure.
25	Function of subscapularis after surgical treatment for recurrent instability of the shoulder using a bone-block procedure (Maynou, Cassagnaud, and Mestdagh 2005)	Maynou et al.	84	4.9	To analyze the function and CT appearance of subscapularis by comparing two different incision techniques; an L-shaped trans-section and splitting of subscapularis.
26	A guided surgical approach and novel fixation method for arthroscopic Latarjet (Boileau, Gendre, and Baba 2016)	Boileau et al.	81	13.5	To evaluate if an arthroscopic Latarjet guiding system improves accuracy of bone block positioning and if suture button fixation could be an alternative to screw fixation in allowing bone block healing and avoiding complications.
27	Recurrent anterior dislocation after the Latarjet procedure: Outcome after revision using a modified Eden-Hybinette operation (Lunn, Castellano-Rosa, and Walch 2008)	Lunn et al.	81	5.8	To assess the results of the modified Eden-Hybinette operation as a salvage procedure after failure of an index Latarjet.
28	Bristow-Latarjet Procedure for Recurrent Anterior Dislocation of the Shoulder - A 2-5 Year Follow-Up-Study on the Results of 112 Cases (Hovelius, Akermark, Albrektsson, et al. 1983)	Hovelius et al.	76	2.0	To evaluate the long-term clinical outcomes and effectiveness of the Bristow-Latarjet procedure in 111 patients who underwent this procedure in four Swedish hospitals from 1975 to 1979.
29	Comparison of arthroscopic and open Latarjet with a learning curve analysis (Cunningham et al. 2016)	Cunningham et al.	72	12.0	To compare arthroscopic and open Latarjet performed by a single shoulder surgeon with learning curve analysis.
30	Does the dynamic sling effect of the Latarjet procedure improve shoulder stability? A biomechanical evaluation (Giles, Boons, Elkinson, et al. 2013)	Giles et al.	71	7.9	To evaluate the effects of the Latarjet procedure, with and without conjoint tendon loading, on shoulder stability and range of motion in 8 cadaveric shoulders.
31	A Prospective Comparative Study of Arthroscopic Versus Mini-Open Latarjet Procedure With a Minimum 2-Year Follow-up (Marion, Klouche, Deranlot, et al. 2017)	Marion et al.	70	14.0	To 1) compare postoperative pain during the first postoperative week and the position of the coracoid bone block at the anterior aspect of the glenoid after the arthroscopic and the mini-open Latarjet procedure and 2) assess functional results and recurrence after at least 2 years of follow-up.
32	The Bristow-Latarjet procedure, a historical note on a technique in comeback (van der Linde, van Wijngaarden, Somford, et al. 2016)	van der Linde et al.	68	11.3	To provide a historical overview, with emphasis on the original inventors Bristow and Latarjet, the complications and following modifications regarding the surgical approach, the coracoid transfer, and the arthroscopic technique.
33	2014 Neer Award	Delaney et al.	68	8.5	To define the stages of the Latarjet

	Paper: Neuromonitoring the Latarjet procedure (Delaney, Freehill, Janfaza, et al. 2014)				procedure during which the nerves are at greatest risk using intraoperative neuromonitoring.
34	Arthroscopic Bankart Repair Versus Open Bristow-Latarjet for Shoulder Instability: A Matched-Pair Multicenter Study Focused on Return to Sport (Blonna, Bellato, Caranzano, et al. 2016)	Blonna et al.	67	11.2	To compare in a case control-matched manner the arthroscopic Bankart repair and open Bristow-Latarjet with particular emphasis on return to sport after surgery.
35	Glenoid Bone Defects-Open Latarjet with Congruent Arc Modification (de Beer and Roberts 2010)	de Beer et al.	66	5.5	To describe patient selection, technique, postoperative rehabilitation, results, and complications of congruent arc modification of the Latarjet procedure.
36	Does the presence of glenoid bone loss influence coracoid bone graft osteolysis after the Latarjet procedure? A computed tomography scan study in 2 groups of patients with and without glenoid bone loss (Di Giacomo, de Gasperis, Costantini, et al. 2014)	Di Giacomo et al.	62	7.8	To investigate the hypothesis that coracoid bone graft osteolysis is more pronounced in cases without glenoid bone loss, which may be due to a diminished mechanotransduction effect at the bone healing site.
37	Short-term Complications of the Arthroscopic Latarjet Procedure: A North American Experience (Athwal, Meislin, Getz, et al. 2016)	Athwal et al.	60	10.0	To report on the intraoperative and early postoperative (<3 months) problems and complications encountered with the arthroscopic Latarjet procedure in patients with complex anterior shoulder instability.
38	Arthroscopic Latarjet Procedure (Lafosse and Boyle 2010)	Lafosse et al.	60	5.0	To answer common clinical questions regarding the arthroscopic Latarjet, and describe relevant operative techniques, postoperative management, clinical results, and complications.
39	Comparison of Glenohumeral Contact Pressures and Contact Areas After Glenoid Reconstruction With Latarjet or Distal Tibial Osteochondral Allografts (Bhatia, Van Thiel, Gupta, et al. 2013)	Bhatia et al.	55	6.1	To investigate changes in the magnitude and location of glenohumeral contact areas, contact pressures, and peak forces after (1) the creation of a 30% anterior glenoid defect and subsequent glenoid bone augmentation with (2) a flush Latarjet coracoid graft or (3) a distal tibial osteochondral allograft.
40	Preliminary clinical outcomes of Latarjet-Patte coracoid transfer by arthroscopy vs. open surgery: Prospective multicentre study of 390 cases (Metais, Clavert, and Barth 2016)	Metais et al.	54	9.0	To evaluate and compare clinical outcomes of the modified Latarjet-Patte procedure performed by open surgery, arthroscopy with screw fixation, or arthroscopy with endobutton fixation.
41	Arthroscopic Latarjet procedure: is optimal	Kany et al.	54	9.0	To 1) document the accuracy of the bone-block position and the direction

	positioning of the bone block and screws possible? A prospective computed tomography scan analysis (Kany, Flamand, Grimberg, et al. 2016)				of the screws after the arthroscopic Latarjet procedure with a multiplanar bidimensional CT scan analysis and evaluate the preoperative and immediate postoperative complications of the procedure 2) evaluate the influence of the learning curve on the duration of the procedure and on the bone-block and screw positions.
42	Injury of the Suprascapular Nerve During Latarjet Procedure: An Anatomic Study (Lädermann, Denard, and Burkhart 2012)	Laedermann et al.	51	5.1	To evaluate the relation between the specific exit point of the screws securing the coracoid graft and the suprascapular nerve during the Latarjet procedure using cadaveric specimens.
43	Coracoid bone graft resorption after Latarjet procedure is underestimated: a new classification system and a clinical review with computed tomography evaluation (Zhu, Jiang, Lu, et al. 2015)	Zhu et al.	49	7.0	To 1) propose a simple and reliable classification system to evaluate the severity of the bone resorption of the transferred coracoid bone block after the Latarjet procedure 2) investigate incidence and severity of graft resorption.
44	Arthroscopic Bankart-Bristow-Latarjet (2B3) Procedure: How to Do It and Tricks To Make it Easier and Safe (Boileau, Mercier, and Old 2010)	Boileau et al.	49	4.1	To describe the surgical technique, postoperative care, and clinical pearls for the arthroscopic Bankart-Bristow-Latarjet (2B3) procedure.
45	An Anatomic, Computed Tomographic Assessment of the Coracoid Process With Special Reference to the Congruent-Arc Latarjet Procedure (Armitage et al. 2011)	Amitage et al.	48	4.4	To determine the dimensions of the coracoid and to compare the radius of curvature (ROC) of the intact glenoid to the ROC of the coracoid undersurface, as oriented in the congruent-arc Latarjet procedure, using computed tomography-based 3-dimensional models of the shoulder.
46	Clinical and computed tomography results of 106 Latarjet-Patte procedures at mean 7.5 year follow-up (Cassagnaud, Maynou, and Mestdagh 2003)	Cassagnaud et al.	48	2.5	To review, at a mean follow-up of 7.5 years, overall functional outcome, bony architecture of the humerus predisposing to anterior instability, and treatment failure after 106 Latarjet-Patte procedures performed in 102 patients.
47	Don't forget the Bristow-Latarjet procedure (Weaver and Derkash 1994)	Weaver et al.	45	1.6	To retrospectively compare the Bankart and Bristow procedures during a 10-year period in terms of complications, rate of recurrence, presence of subluxation, range of motion, return to activity, strength, pain, and overall satisfaction.
48	The Bristow and Latarjet Procedures: Why These Techniques Should Not Be Considered Synonymous (Giles et al. 2014)	Giles et al.	44	5.5	To compare the biomechanical effects of the Bristow and Latarjet procedures using cadaveric specimens.
49	Risk factors for dislocation arthropathy after	Laedermann et al.	44	4.9	To analyze the long-term incidence of dislocation arthropathy after a modified Latarjet procedure for

	Latarjet procedure: a long-term study (Lädermann, Lubbeke, Stern, et al. 2013)				glenohumeral instability.
50	An anatomic study of the coracoid process as it relates to bone transfer procedures (Dolan et al. 2011)	Dolan et al.	44	4.0	To describe the soft tissue attachments of the coracoid as they relate to the bony anatomy and to define the average amount of bone available for use in coracoid transfer using cadaveric specimens.

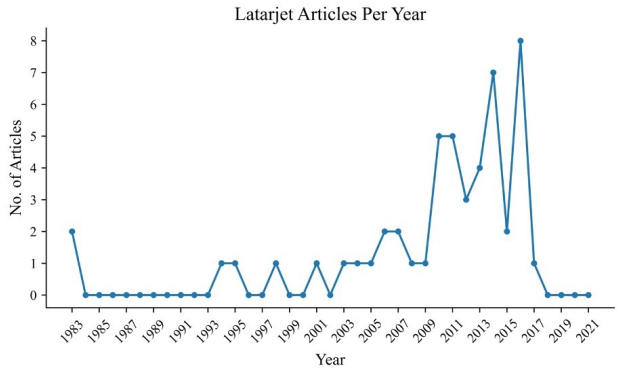

Figure 1. Sum of total Top 50 Latarjet articles published per year

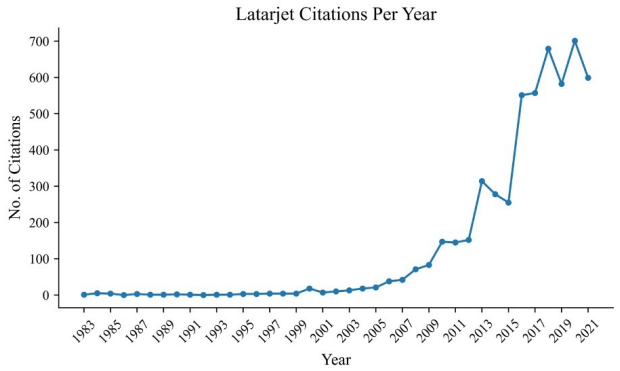

Figure 2. Number of citations per year of Top 50 Latarjet articles

Burkhart et al., published in 2007, had the highest citation density at 23 citations per year. Burkhart et al. also had the second most citations overall (349).

The earliest publication year of all the articles in our study was 1983 (Figure 1). Two of the top 50 articles were published in 1983, and another top-50 Latarjet article was not published until 1994. There were 8 top 50 Latarjet articles published in 2016, which is the most among all years represented in our study. Following 2016, there was 1 top-50 article published in 2017, and none since 2017. There was also a dip between 2014 and 2016, with only 2 top-50 articles published in 2015. The overall trend shows that the majority of top 50 most-cited Latarjet articles were published after the year 2000. The median year of publication was 2012.

The total number of citations among top 50 Latarjet papers has increased exponentially since 1983 (Figure 2), when the first high-impact Latarjet article was published. In 2021 alone, the top 50 Latarjet articles were cited a total of 599 times. The single year with the most citations was 2020 with 701 citations.

A total of 17 countries were represented by the authors of the articles in our study (Figure 3). France represented the highest number of author affiliations at 27% (n=14). The United States (n=8, 16%), Sweden (n=5, 10%), and Switzerland (n=4, 8%) followed France with the most author affiliations within our study. Five countries (Australia, Belgium, Germany, Japan, South Africa) were represented in 2 top-50 articles each, and five countries (China, India, Netherlands, Poland, Spain) were represented in a single top-50 article.

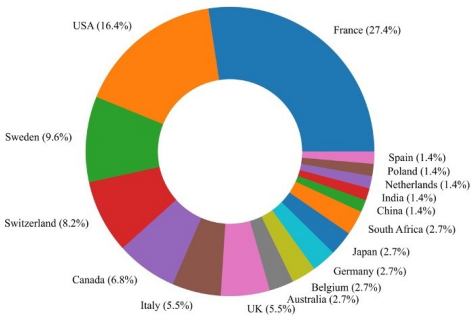

Figure 3. Country of origin for authors of the top 50 Latarjet articles.

There was significant variation with respect to study type and level of evidence of the articles in our study. The most common study type was case series (24 articles). The least represented study type was prospective cohort studies, of which there were three (Table 2). Other study types included retrospective cohort studies (9), biomechanical/cadaveric studies (8), and expert opinions (6). There were no RCTs within the top 50 most-cited Latarjet articles. Level of evidence category IV was most common among the articles in our study (25 articles). There were no articles that fit the level of evidence category I. There were, however, 3 articles with level of evidence II, 9 with level III, and 14 with level V (Figure 4).

Table 2. Articles classified by study type.

Study Type	No. of Articles
Case Series	24
Cohort Study - Retrospective	9
Biomechanical/Cadaveric Study	8
Expert Opinion	6
Cohort Study - Prospective	3
Basic Science	0
Case-Control Study	0
Case Report	0
Nonrandomized Control Trial	0
Randomized Control Trial	0

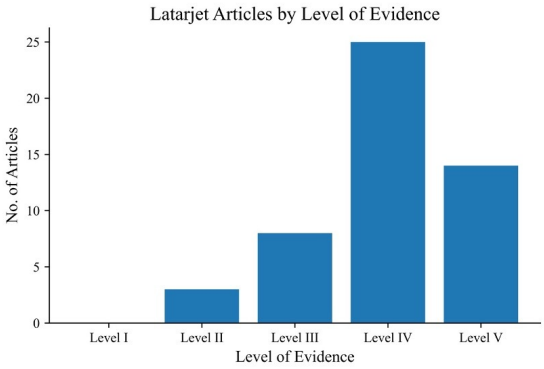

Figure 4. Level of evidence represented by top 50 Latarjet articles.

The articles in our study were published in various journals by many different authors. The top-50 articles were published in 13 different orthopedic journals (Table 3). Seventeen articles were published in the *Journal of Shoulder and Elbow Surgery*, which published the most top-50 articles. The other most-cited journals included *Arthroscopy* (7), The *Journal of Bone and Joint Surgery American* (6), the *American Journal of Sports Medicine* (5), and the *Journal of Bone and Joint Surgery British (2),* which is now The Bone & Joint Journal (Table 3). The author with the most first-author top 50 Latarjet publications was Hovelius, with 7 articles. Meanwhile, Boileau was the second most-published first author with 4 top 50 articles.

DISCUSSION

Our bibliometric analysis found that the top fifty most-cited articles on the Latarjet procedure were case series studies (24) and studies with Level IV evidence (25), a finding that has been observed in many bibliometric analyses in orthopedic surgery (Lefaivre, Shadgan, and O'Brien 2011; Moore et al. 2021; Barbera, Selverian, Courington, et al. 2020; Baldwin, Kovatch, Namdari, et al. 2012; Holzer and Holzer 2014). This finding suggests the need for a greater number of higher-level evidence studies on the Latarjet procedure, though this need is certainly not unique to the Latarjet procedure, as this trend and has been observed in other areas as well (Namdari, Baldwin, Kovatch, et al. 2012; Holzer and Holzer 2014). We also noted that there were no Level I studies amongst this body of literature that is highly influential to surgeons. While general guidelines exist on the optimal management of shoulder instability based on patient-specific factors, there are no consensus recommendations regarding which procedure surgeons should use and which technique is best (i.e. open versus arthroscopic). While this lack of consensus may be partly due to the rapid evolution and adoption of techniques (i.e. arthroscopic bone-block, etc), the lack of Level I evidence may be related to the lack of consensus. The findings of this article-review are important, and emphasize the need for higher-level studies on this topic.

We also observed that 12 studies (24%) were classified as cohort studies (prospective and retrospective), while in a similar study on most cited articles on rotator cuff surgery (Sochacki et al. 2018), only 5 articles (10%) were classified as cohort studies (prospective and retrospective). This may be due to interest in comparing the Latarjet procedure to other shoulder stabilization techniques such as the Bankart repair, particularly given that there no consensus on either procedure's use as the gold standard treatment for recurrent anterior shoulder instability (Imam, Shehata, Martin, et al. 2021), in the primary or revision setting (Calvo, Luengo, Morcillo, et al. 2021). Retrospective and prospective cohort studies could have been used to uncover differences in outcomes between these procedures, thereby providing evidence for one procedure to be favored over the other for a given indication. Another finding was that the third most common study design among the top 50 most-cited Latarjet papers was biomechanical/cadaveric (8). This trend aligns with results of previous bibliometric analyses of shoulder instability (Allahabadi, Eftekhari, Feeley, et al. 2021), and reflects the ongoing efforts to fully understand the complex mechanics of shoulder instability.

We also noted that the majority (45) of top 50 most-cited papers were published after 2000, with a particularly high density (35) between 2010 and 2016 (Figure 1), a finding similarly-observed in bibliometric analyses on hip

Table 3. Journals represented by top 50 Latarjet articles.

Journal	No. of Articles
Journal of Shoulder and Elbow Surgery	17
Arthroscopy – The Journal of Arthroscopy and Related Surgery	7
Journal of Bone and Joint Surgery – American Volume	6
American Journal of Sports Medicine	5
Clinical Orthopaedics and Related Research	3
Orthopedic Clinics of North America	3
Knee Surgery Sports Traumatology Arthroscopy	2
Journal of Bone and Joint Surgery – British Volume	2
International Orthopaedics	1
Current Reviews in Musculoskeletal Medicine	1
Orthopaedics & Traumatology – Surgery & Research	1
Revue de Chirurgie Orthopédique Et Réparatrice de l'Appareil Moteur	1
Acta Orthopaedica Scandinavica	1

arthroscopy (Barbera, Selverian, Courington, et al. 2020) and shoulder arthroscopy (Moore et al. 2021), which both saw a prevalence of studies published in the late 2000s. This trend aligns with the growing interest in the arthroscopic Latarjet procedure, which is a much more recent (Lafosse, Lejeune, Bouchard, et al. 2007) development, relatively speaking (Wong, Friedman, and Garrigues 2020; van der Linde, van Wijngaarden, Somford, et al. 2016). In our citation analysis, 13 of the top 50 most-cited Latarjet articles specifically examined arthroscopic Latarjet, 12 of which were published after 2009. Therefore, the high density of top 50 most-cited Latarjet papers published between 2010 and 2016 may be partly due to the rapid development and expansion of arthroscopic technologies over the past two decades (Moore et al. 2021). Although technically demanding, the arthroscopic Latarjet may offer advantages including lower invasiveness for associated lesions (Lafosse and Boyle 2010; John and Wong 2019; Lafosse, Lejeune, Bouchard, et al. 2007; Castricini, De Benedetto, Orlando, et al. 2013).

The increasing interest in the arthroscopic latarjet likely affects not only the observed trend in publication date, as discussed above, but also likely influences the observed trend related to level of evidence.New treatments and ideas are usually presented through observational studies with lower level-of-evidence (Namdari, Baldwin, Kovatch, et al. 2012). As arthroscopic Latarjet is still in its relatively early stages, many of today's most-cited articles may form the foundation that current and future higher level-of-evidence studies build upon in their research. In contrast to Moore et al's prediction that RCTs will displace case series and expert opinion articles in future analyses of most-cited shoulder arthroscopy studies, future high-impact studies may include long-term case series that provide long-term data on the arthroscopic Latarjet (Moore et al. 2021). In regard to the traditionally open Latarjet, an older procedure than arthroscopic Latarjet, some randomized control trials may replace lower level-of-evidence studies currently in the top 50. This trend has been observed in citation analyses of older procedures such as hip and knee arthroplasty (Holzer and Holzer 2014; Piuzzi, Sultan, Gatta, et al. 2019), such as Kukkonen et al's RCT on arthroscopic Bankart versus open Latarjet procedure in the treatment of traumatic shoulder instability in young males (Kukkonen, Elamo, Flinkkilä, et al. 2021).

There are many other factors that contribute to the citation frequency of a scientific article, including the originality of the findings, the rigor of the research methodology, its potential to change clinical practice, and its ability to influence new research inquiries. Additionally, numerous bibliometric analyses in both orthopedics and healthcare broadly have shown that the time amassed since an article's publication contributes significantly to the number of citations it receives (Namdari, Baldwin, Kovatch, et al. 2012; Allahabadi, Eftekhari, Feeley, et al. 2021; Moore et al. 2021; Adams and Simonson 2004; Ahmad, Evangelopoulos, Abbasian, et al. 2014). as articles published earlier form a foundation for future articles to build and expand upon (Barbera, Selverian, Courington, et al. 2020). The present study's findings also highlight the significant contributions of French surgeons to this area.

Authors of French origin contributed the highest number of studies to the top fifty most-cited articles on the Latarjet procedure. These results differ from other bibliometric analyses in orthopedic surgery and various other medical specialties where American authors have often produced the highest number of most-cited articles (Lefaivre, Shadgan, and O'Brien 2011; Namdari, Baldwin, Kovatch, et al. 2012; Moore et al. 2021; Barbera, Selverian, Courington, et al. 2020; Merigó and Núñez 2016; Loonen, Hage, and Kon 2008; Paladugu et al. 2002). The unique trend observed in this study likely reflects the pioneering contribution that French surgeons and researchers played in the development and use of the Latarjet procedure over the last half-century (Latarjet 1954). It may also reflect the preference of French surgeons for the Latarjet as a first-line

surgical treatment modality for recurrent shoulder instability, given their successful outcomes (Imam, Shehata, Martin, et al. 2021; Thomazeau, Courage, Barth, et al. 2010). The successful track-record of the Latarjet by French surgeons likely continues to drive research and publication regarding this surgical technique. It is also unclear to what degree, if any, these results may be influenced by the large volume of orthopedic shoulder research produced in France and the United States, or biases in the publication process for French and American authors more broadly.

In addition to the length of time since publication and author country of origin, the publishing journal likely contributes to the overall number of citations an article obtains. Approximately one-third of the fifty most-cited articles were published in the *Journal or Shoulder and Elbow Surgery*, with *Arthroscopy* and *Journal of Bone and Joint Surgery (American Volume)* publishing the second and third most articles, respectively. This trend was not surprising considering these journals are well-established and popular, high-impact journals at the forefront of orthopedics and shoulder surgery.

As the arthroscopic Latarjet continues to evolve and expand over the coming years, the articles included in this analysis can serve as a starting point for understanding both the history and evolving landscape of the Latarjet procedure. This analysis of the most-cited articles on the Latarjet procedure can provide students, trainees and practicing orthopedic surgeons with a list of "should read" articles on this topic (Namdari, Baldwin, Kovatch, et al. 2012).

LIMITATIONS

Bibliometric and citation analyses have inherent limitations. The use of fifty articles as a cutoff in this study was arbitrary and may have led to other "influential" and "important" articles being omitted. However, this seems to be an established adequate number from which meaningful observations can be made (Namdari, Baldwin, Kovatch, et al. 2012; Bondar, Damodar, Schiller, et al. 2021; Allahabadi, Eftekhari, Feeley, et al. 2021; Moore et al. 2021). Second, related to the previous limitation, because this bibliometric analysis was based on an eponymous procedure, it inevitably excluded some early influential papers that did not yet refer to "Latarjet" as the name of this procedure. Though some prior descriptive manuscripts may have been excluded, we feel that our search captured the most influential articles for today's readership. Another potential limitation, which has been recognized by other citation analyses, is that of a "snowball effect" that may have caused articles to have an artificially inflated number of citations (Lefaivre, Shadgan, and O'Brien 2011; Namdari, Baldwin, Kovatch, et al. 2012; Ahmad, Evangelopoulos, Abbasian, et al. 2014). This term describes a phenomenon by which authors are more likely to cite an article because it was previously cited, rather than citing it based on content or quality. While unavoidable, this phenomenon should be recognized by the reader, and emphasizes the need for personal and individual scrutiny of a publication prior to citing it oneself. Additionally, both citation density and total number of citations can be inflated by self-citations. For example, an author who regularly produces work on a specific topic is more likely to cite their past work and thereby increase their total number of citations, which is a consideration, but that would not affect the results presented here. Finally, there was some degree of inherent subjectivity in the inclusion and exclusion of each article in this study. To mitigate any bias or subjectivity in this regard, we incorporated various levels of review, across different levels of experience (e.g., medical students, residents, attending), when determining inclusion and exclusion.

CONCLUSION

The most-cited articles on the Latarjet procedure tend to be case series, cohort studies, and expert opinions published primarily by French and American authors between 2000 and 2016. With the recent technical innovation surrounding the Latarjet procedure and glenoid bone-block reconstruction in general, these articles may form the foundation that future higher level-of-evidence studies will build upon in their research. These findings highlight the need for higher level studies in this rapidly evolving field.

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