OPEN ACCESS

ORIGINAL ARTICLE

Functional Outcome of Congruent ARC Laterjet Procedure in Off Track Lesions of Shoulder with Recurrent Anterior Shoulder Instability

Nauman Ashraf[1], Sobia Aziz[1], Muhammad Sufyan[1], Muhammad Kazim Rahim[1], Hira Kiani[2]

[1]Department of Orthopedic Surgery, Liaquat National Hospital, Karachi
[2]Advanced Research Services, Islamabad

Authorship and Contribution Declaration
Each author of this article has encountered all 04 criterions of authorship:

1. Commencement and design of the study, attainment of data, or analysis and interpretation of information.
2. Drafting the manuscript or rewriting it censoriously for important intellectual content.
3. Providing concluding endorsement of the version for publication.
4. All authors have settled to be answerable for all aspects of their research work

Corresponding author:
Nauman Ashraf
E-mail:
naumanmalik051@gmail.com

ABSTRACT

Objective: To evaluate the functional outcomes of the congruent arc Latarjet procedure in off-track lesions with recurrent shoulder instability.
Methods: This retrospective study included 25 patients who underwent surgical treatment for recurrent anterior shoulder instability at Liaquat National Hospital between January 2017 and January 2021. The patients met the inclusion criteria of having recurrent shoulder instability with glenoid bone loss exceeding 20% and an off-track lesion. The Congruent Arc Latarjet procedure was performed on all patients. The functional outcomes of the patients were evaluated using the visual analogue score (VAS), Rowe score, and range of motion before surgery and at 1, 6, 12, and 24 months postoperatively.
Results: A total of 25 patients were evaluated post-operatively for 24 months. VAS and ROWE score improved from 7.4 ± 0.91 and 20.80 ± 2.46 preoperatively to 1.48 ± 0.58 and 95.76 ± 1.83 respectively ($p < 0.05$) at 24 months postoperatively. Based on ROWE score, 23 (92%) had an excellent outcome and 2 (8%) had a good outcome 24 months after the surgery. Range of motion also improved significantly from forward flexion improving to 160.1 ± 7.01 from 72.84 ± 3.98 and external rotation to 45.16 ± 2.89 from 9.60 ± 2.34, at 24 months postoperatively.
Conclusion: The congruent arc Laterjet procedure is an effective technique for the treatment of recurrent shoulder instability with off-track lesions as it produced excellent outcome in restoring shoulder function and stability.
Keywords: Congruent arc Latarjet, Recurrent anterior shoulder instability, Off-track lesion.

This article may be cited as: Ashraf N, Aziz S, Sufyan M, Rahim MK, Kiani H. Functional Outcome of Congruent Arc Laterjet Procedure in Off-Track Lesions of Shoulder with Recurrent Anterior Shoulder Instability. J. Pak. Orthop. Assoc. 2024; Vol. 36 (4):224-229.

INTRODUCTION

The natural architecture of the glenohumeral joint makes the shoulder the unstable joint and therefore is the most frequently dislocated joint.[1,2] Generally, the mechanism of injury is "forced abduction and external rotation". It is mostly seen in young males involved in contact sports, weightlifting, heavy labor, gym or military training. In patients with recurrent dislocations, glenoid bone lesions have been present in 86%, whereas humeral lesions are seen in up to 100% of patients.[3-5] Furthermore, 60% - 70% of patients have bipolar lesions, which are a risk factor for recurrence.[6-8] Understanding of the glenohumeral joint and its stabilizers, along with different imaging modalities, aids in recognition of these defects which is crucial for the selection of treatment plan accordingly and for attaining improved outcomes.

The concept of the glenoid track was introduced by Yamamoto, which can predict bony stability by identifying the integrity of the track and the location of the lesion.[9] Glenoid track is defined as the contact area between the superolateral aspect of the posterior humeral head and the glenoid when the arm is in abduction and external rotation. Hill Sachs

lesions, considerably larger, are more likely to be engaging, with one study showing a decrease in stability once there is 25% involvement of humeral head.[10] Recent studies have specified the importance of the position of the lesion within the track, with peripheral track lesions representing a more meaningful lesion.[11] Multiple studies have been conducted regarding the treatment plan according to the size, type of the lesion and area involved.[12-16] In patients with a small on-track Hill Sachs lesion and <10 % glenoid bone loss, an isolated arthroscopic Bankart repair is suitable. With an engaging Hill Sachs lesion and <15 % glenoid bone loss, remplissage procedure is added to the arthroscopic Bankart repair. For patients with ≤15 % bone loss or a previous failed arthroscopic repair, open Bankart repair is endorsed. Latarjet is the procedure of choice in patients with non-engaging Hill Sachs lesion with >15 % bone loss. In patients with bone loss of >30 % bone grafting with iliac crest is the proposed option.

The Latarjet procedure is a known method for anterior glenoid bone loss, through the transfer of coracoid process and conjoint tendon to the anterior glenoid, restoring the bony stability.[17-19] In classic Latarjet procedure, osteotomy is done at the elbow of the coracoid, followed by transfer and fixation of the coracoid in a way that the lateral surface is flushed with the articular surface of the glenoid.[20-22] De Beer's modification of the classic technique is known as the congruent-Arc Laterjet, in which the coracoid is rotated 90 degrees along its longitudinal axis, which allows the curvature on the inferior surface of the coracoid create the natural curvature of the glenoid arc, which improves joint congruity and stability, requiring minimal decortication, which aids in preserving bone stock of the graft.[23,24]

Our study aims to evaluate the functional outcomes of the congruent arc Latarjet procedure in off-track lesions with recurrent shoulder instability.

METHODS

This retrospective study included 25 patients who underwent surgical treatment for recurrent anterior shoulder instability at Liaquat National Hospital, Karachi between January 2017 and January 2021. Approval from the institutional review board was obtained before the study commenced. Inclusion criteria for this study were patients who had congruent arc Latarjet procedure for recurrent shoulder instability with glenoid bone loss exceeding 20% and an off-track lesion and were followed up for two-years. Patients were excluded if they had concomitant procedures (i.e. Latarjet combined with remplissage or bankart repair or posterior labral repair) posterior or multidirectional instability, previous shoulder surgery of involved shoulder, or neurological injury in the limb involved. Patients with systemic laxity (Beighton score ≥ 6) were excluded as they have poor outcomes following Latarjet.

Questionnaire for each patient was filled which included demographic data, co-morbidities, pre and post-operative examination findings and radiological findings. During pre-operative examination, all patients had a positive anterior apprehension and relocation test. Patients were labelled to have recurrent anterior instability if they had one or more dislocations or the presence of recurrent subluxation. The radiographic evaluation was done using X-rays (Antero-posterior, lateral, scapular Y, and axillary views) and MRI shoulder was performed on all the patients. The bipolar bone loss and 'On Track and Off track lesions' were calculated on MRI films using the best fit circle method[25].

During the surgical procedure, patients received general anesthesia and were placed in the beach-chair position. After surface anatomy markings, standard deltopectoral approach was utilized. The coracoid was identified and the coracoacromial ligament (CAL) was incised at the middle leaving a stump for later capsular reinforcement. The pectoralis minor tendon was released from the medial coracoid. An osteotomy was performed from the medial to lateral direction at the base of the coracoid. The coracoid graft was held gently with forceps and coracohumeral ligament was released, completing coracoid graft preparation. As congruent arc Latarjet was being done, the coracoid graft was rotated 90 degrees on its longitudinal axis, such that the original medial surface was facing the glenoid neck. In this configuration, the curved underside aligns with the anteroinferior aspect of the glenoid, ensuring congruence, while the inner surface serves as a platform for bone fusion. The subscapularis muscle was divided in line with the fibers at the 2/3rd superior and 1/3rd inferior junction to expose the anterior capsule that was divided in the same manner. The anterior aspect of the glenoid neck was meticulously prepared using a saw blade to serve as the bed for receiving the coracoid bone graft. Subsequently, the graft was temporarily anchored in place using 2-mm pins. Definitive screw fixation is performed using partially threaded two 3.5 mm cannulated screws following the lag principle.

Additionally, the remaining portion of the coracoacromial ligament connected to the coracoid

process was sutured together with the capsule, thereby enhancing the capsule's strength. Mobility was checked and closure was done in all layers. Patients were always kept in a sling for 6 weeks following surgery. During this time, passive range of motion was progressed while active range of motion was restricted. At 6-12 weeks post-operatively, active range of motion was initiated. Strengthening exercises were initiated from 12-16 weeks and patients were allowed to return to all activities at six months post-operatively.

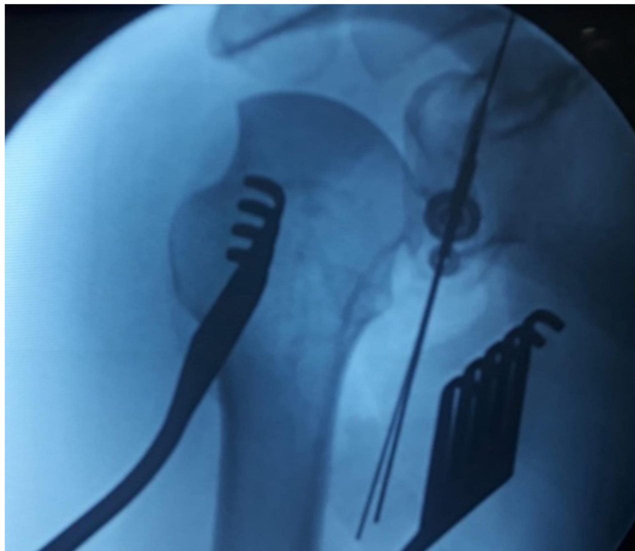

Figure 1: Intraoperative radiograph showing coracoid graft fixed with 2 partially threaded 3.5mm cannulated screws

The functional outcomes of the patients were evaluated using the visual analogue score (VAS), Rowe score, and range of motion before surgery and at 1, 6, 12, and 24 months postoperatively. The Rowe score (26) was used as an outcome measure, it includes questions regarding shoulder stability, motion, and function. Scores range from 0 to 100 with a score of 90-100 points indicating an excellent outcome, 75-89 points indicating a good outcome, 51-74 points indicating a fair outcome, and 0-50 points indicating a poor outcome. A visual analog scale (VAS) was used to assess pain (ranging from 0-10). ROM was recorded and compared with the normal shoulder.

Statistical analysis was performed through IBM SPSS software version 25. Paired sample t-test was used to analyze the differences before and after the procedure. P-value less than 0.05 was considered significant.

RESULTS

A total of 25 patients were evaluated post-operatively for 24 months. Out of 25 patients, 22 were males and 3 were females, with mean age of 29.1 ± 7.24 years.

VAS and ROWE score improved from 7.4 ± 0.91 and 20.80 ± 2.46 preoperatively to 1.48 ± 0.58 and 95.52 ± 2.43 respectively ($p < 0.05$) at 24 months postoperatively, as given in table 1. Based on ROWE score, 92% (n=23) had an excellent outcome and 8% (n=2) had a good outcome 24 months after the surgery. Range of motion also improved significantly from forward flexion improving to 160.1 ± 7.01 from 72.84 ± 3.98 and external rotation to 45.16 ± 2.89 from 9.60 ± 2.34, at 24 months postoperatively. Figure 2 and 3 show the forward flexion and external rotation of a patient 6 months after the surgery.

Table:

Sr No.		Pre-Operative	1 month follow up	6 months follow up	12 months follow up	24 months follow up
1.	VAS	7.40 ± 0.91	4.32 ± 1.10	1.96 ± 0.61	1.48 ± 0.58	1.48 ± 0.58
2.	ROWE score	20.8 ± 2.46	44.12 ± 3.15	87.72 ± 3.55	93.45 ± 3.67	95.52 ± 2.43
3.	Range of motion					
a.	Forward flexion	72.8 ± 3.98	81.9 ± 3.74	110.1 ± 4.84	144.1 ± 4.58	160.1 ± 7.01
b.	External rotation	9.6 ± 2.34	15.3 ± 6.29	27.8 ± 4.66	37.0 ± 4.51	45.1 ± 2.89

DISCUSSION

Our study showed significant improvement in VAS and ROWE score which preoperatively were 7.40 ± 0.91 and 20.80 ± 2.46 to 1.48 ± 0.58 and 95.52 ± 2.43 respectively ($p < 0.05$) at 24 months postoperatively. 92% of the patients had an excellent outcome along with significant progress in range of motion over 24 months after modified latarjet procedure, with forward flexion improving to 160.1 ± 7.01 from 72.84 ± 3.98 and external rotation to 45.16 ± 2.89 from 9.60 ± 2.34.

In a similar study by R.A.Musa et al. (27), 20 patients were evaluated for a period of 24 months postoperatively, ROWE score and ASES score significantly improved from 20.36 ± 8.87 to 89.64 ±

5.71 and 22.60 ± 1.09 to 72.50 ± 7.33 respectively. There were no dislocations. In another study by L.A.Rossi et al. (28) 96% returned to competitive sports; 91% returned to their preinjury level of play. Following surgery, there were significant improvements in the Rowe, VAS, and ASOSS scores ($P < .001$), increasing from 43.8 to 96.1, from 3.3 to 1.2, and from 46.3 to 88.1, respectively.

Latarjet surgery is the most widely used procedure as it provides triple effect for the support of anterior shoulder instability. First, the surface area of the glenoid safe is increased with the coracoid transfer to the glenoid rim arc. Second, anterior capsule is reinforced by the conjoined tendon which prevents forward translation of the humeral head (sling effect) when the arm is externally rotated and abducted. Finally, there is restoration of the bumper effect of the glenoid labrum and anterior capsule. (29) With the congruent arc modification, stabilization is improved by anatomic differences in the reconstructed glenoid surface augmentation. Previous anatomic and radiological studies regarding the glenoid surface augmentation demonstrated that 29% to 36% of the glenoid surface area can be reconstructed using the classic Latarjet, whereas, using the congruent arc modification, up to 53% of the glenoid may be restored. (30-33) Larger glenoid surface area restoration of glenohumeral joint provides greater stability among patients undergoing congruent arc latarjet procedure.

Few comparison studies are also seen in literature. In a study by H. F. Mahmoud et al. (34) including 50 patients; half underwent Latarjet, and the other half underwent arthroscopic tricortical iliac crest bone grafting (ICBG). It concluded that, both procedures had satisfactory functional results in reconstruction of glenoid defect of >20% in unstable shoulders with no difference in the Constant and UCLA scores, but Latarjet procedure had fewer complications (4%) than ICBG (24%). A meta-analysis comparing classic vs congruent arc Latarjet, by S. R. B. Mengers et al. (35) showed no difference between the postoperative Rowe or VAS scores, complications or return-to-sports. When comparing outcomes, the classic Latarjet procedure had a significantly lower incidence of fibrous union or nonunion, broken or loose, or improperly placed screws. On the other hand, congruent arc modification demonstrated significantly improved outcomes regarding return to sports, incidence of subluxation or positive apprehension test, and revision surgery for recurrent instability.

Figure 2: Forward flexion 6 months after the surgery

Figure 3: External rotation 6 months after the surgery

There are certain limitations in our study. Foremost is a small sample size and a single-center study. Second, there is no head-to-head comparison between classic Latarjet and any other procedures. It is a retrospective study, and all the limitations of retrospective studies apply to our cohort. Our study population did not have professional athletes, especially those in contact sports as functional demands of these patients may be different from our study population. Post-operative CT scan findings were not included in our study, which is important for assessment of graft consolidation and remodeling.

CONCLUSION

The congruent arc Laterjet procedure is an effective technique for the treatment of recurrent shoulder instability with off-track lesions as it produced excellent outcomes in restoring shoulder function, range of motion and stability. More comparative studies and evaluation over a longer follow-up period are necessary to evaluate osteoarthritic changes in patients undergoing shoulder stabilization with the congruent arc Latarjet procedure and the superiority of this procedure over others.

Conflict of Interest: None

Grants/Funding: None

Disclaimer: None

REFERENCES

1. De Carli A, Vadalà A, Proietti L, Ponzo A, Desideri D, Ferretti A. Latarjet procedure versus open capsuloplasty in traumatic anterior shoulder dislocation: long-term clinical and functional results. International Orthopaedics. 2019;43:237-42.
2. Cautiero F, Russo R, Di Pietto F, Sabino G. Computerized tomographic assessment and clinical evaluation in shoulder instability treated with the Latarjet-Patte procedure using one screw and washer. Muscles, Ligaments and Tendons Journal. 2017;7(1):26.
3. Xu J, Liu H, Lu W, Deng Z, Zhu W, Peng L, et al. Modified arthroscopic Latarjet procedure: suture-button fixation achieves excellent remodeling at 3-year follow-up. The American Journal of Sports Medicine. 2020;48(1):39-47.
4. Rowe C, Zarins B, Ciullo J. Recurrent anterior dislocation of the shoulder after surgical repair. Apparent causes of failure and treatment. JBJS. 1984;66(2):159-68.
5. Moroder P, Hirzinger C, Lederer S, Matis N, Hitzl W, Tauber M, et al. Restoration of anterior glenoid bone defects in posttraumatic recurrent anterior shoulder instability using the J-bone graft shows anatomic graft remodeling. The American Journal of Sports Medicine. 2012;40(7):1544-50.
6. Nakagawa S, Ozaki R, Take Y, Iuchi R, Mae T. Relationship between glenoid defects and Hill-Sachs lesions in shoulders with traumatic anterior instability. The American journal of sports medicine. 2015;43(11):2763-73.
7. Di Giacomo G, Itoi E, Burkhart SS. Evolving concept of bipolar bone loss and the Hill-Sachs lesion: from "engaging/non-engaging" lesion to "on-track/off-track" lesion. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2014;30(1):90-8.
8. Burkhart SS, De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2000;16(7):677-94.
9. Yamamoto N, Itoi E, Abe H, Kikuchi K, Seki N, Minagawa H, et al. Effect of an anterior glenoid defect on anterior shoulder stability: a cadaveric study. The American journal of sports medicine. 2009;37(5):949-54.
10. Ahmed I, Ashton F, Robinson CM. Arthroscopic Bankart repair and capsular shift for recurrent anterior shoulder instability: functional outcomes and identification of risk factors for recurrence. JBJS. 2012;94(14):1308-15.
11. Yamamoto N, Shinagawa K, Hatta T, Itoi E. Peripheral-track and central-track Hill-Sachs lesions: a new concept of assessing an on-track lesion. The American Journal of Sports Medicine. 2020;48(1):33-8.
12. Moroder P, Odorizzi M, Pizzinini S, Demetz E, Resch H, Moroder P. Open Bankart repair for the treatment of anterior shoulder instability without substantial osseous glenoid defects: results after a minimum follow-up of twenty years. The Journal of Bone and Joint surgery American Volume. 2015;97(17):1398.
13. Garcia GH, Wu H-H, Liu JN, Huffman GR, Kelly IV JD. Outcomes of the remplissage procedure and its effects on return to sports: average 5-year follow-up. The American journal of sports medicine. 2016;44(5):1124-30.
14. Franceschi F, Papalia R, Rizzello G, Franceschetti E, Del Buono A, Panascì M, et al. Remplissage repair—new frontiers in the prevention of recurrent shoulder instability: a 2-year follow-up comparative study. The American Journal of Sports Medicine. 2012;40(11):2462-9.
15. Boileau P, O'Shea K, Vargas P, Pinedo M, Old J, Zumstein M. Anatomical and functional results after arthroscopic Hill-Sachs remplissage. JBJS. 2012;94(7):618-26.
16. Bessière C, Trojani C, Carles M, Mehta SS, Boileau P. The open Latarjet procedure is more reliable in terms of shoulder stability than arthroscopic Bankart repair. Clinical Orthopaedics and Related Research®. 2014;472:2345-51.
17. Rabinowitz J, Friedman R, Eichinger JK. Management of glenoid bone loss with anterior shoulder instability: indications and outcomes. Current Reviews in Musculoskeletal Medicine. 2017;10:452-62.
18. McHale KJ, Sanchez G, Lavery KP, Rossy WH, Sanchez A, Ferrari MB, et al. Latarjet technique for treatment of anterior shoulder instability with glenoid bone loss. Arthroscopy techniques. 2017;6(3):e791-e9.
19. John R, Wong I. Innovative approaches in the management of shoulder instability: current concept review. Current Reviews in Musculoskeletal Medicine. 2019;12:386-96.
20. Beranger JS, Klouche S, Bauer T, Demoures T, Hardy P. Anterior shoulder stabilization by Bristow–Latarjet procedure in athletes: return-to-sport and functional outcomes at minimum 2-year follow-up. European Journal of Orthopaedic Surgery & Traumatology. 2016;26:277-82.
21. Baverel L, Colle P-E, Saffarini M, Anthony Odri G, Barth J. Open Latarjet procedures produce better outcomes in competitive athletes compared with recreational athletes: a clinical comparative study of 106 athletes aged under 30

years. The American Journal of Sports Medicine. 2018;46(6):1408-15.

22. Balestro J-C, Young A, Maccioni C, Walch G. Graft osteolysis and recurrent instability after the Latarjet procedure performed with bioabsorbable screw fixation. Journal of Shoulder and Elbow Surgery. 2015;24(5):711-8.
23. Dumont GD, Vopat BG, Parada S, Cohn R, Makani A, Sanchez G, et al. Traditional versus congruent arc Latarjet technique: effect on surface area for union and bone width surrounding screws. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2017;33(5):946-52.
24. de Beer JF, Roberts C. Glenoid bone defects—open Latarjet with congruent arc modification. Orthopedic Clinics. 2010;41(3):407-15.
25. Gyftopoulos S, Beltran LS, Bookman J, Rokito A. MRI Evaluation of Bipolar Bone Loss Using the On-Track Off-Track Method: A Feasibility Study. AJR Am J Roentgenol. 2015 Oct;205(4):848-52. doi: 10.2214/AJR.14.14266. PMID: 26397335.
26. Rowe C, Patel D, Southmayd W. The Bankart procedure: a long-term end-result study. JBJS. 1978;60(1):1-16.
27. Musa RA, Patel MJ, Gupta YR, Shah PK, Solanki MS, Bhavsar NM. The congruent arc latarjet procedure–Its functional outcomes in recurrent anterior shoulder dislocation with critical glenoid bone loss. Journal of Orthopaedics, Trauma and Rehabilitation. 2023;30(1):22104917221136281.
28. Rossi LA, Bertona A, Tanoira I, Maignon GD, Bongiovanni SL, Ranalletta M. Comparison between modified Latarjet performed as a primary or revision procedure in competitive athletes: a comparative study of 100 patients with a minimum 2-year follow-up. Orthopaedic Journal of Sports Medicine. 2018;6(12):2325967118817233.
29. Young AA, Maia R, Berhouet J, Walch G. Open Latarjet procedure for management of bone loss in anterior instability of the glenohumeral joint. Journal of shoulder and elbow surgery. 2011;20(2):S61-S9.
30. Montgomery SR, Katthagen JC, Mikula JD, Marchetti DC, Tahal DS, Dornan GJ, et al. Anatomic and biomechanical comparison of the classic and congruent-arc techniques of the Latarjet procedure. The American journal of sports medicine. 2017;45(6):1252-60.
31. Ljungquist KL, Butler RB, Griesser MJ, Bishop JY. Prediction of coracoid thickness using a glenoid width–based model: implications for bone reconstruction procedures in chronic anterior shoulder instability. Journal of shoulder and elbow surgery. 2012;21(6):815-21.
32. Giles JW, Puskas G, Welsh M, Johnson JA, Athwal GS. Do the traditional and modified Latarjet techniques produce equivalent reconstruction stability and strength? The American Journal of Sports Medicine. 2012;40(12):2801-7.
33. Armitage MS, Elkinson I, Giles JW, Athwal GS. An anatomic, computed tomographic assessment of the coracoid process with special reference to the congruent-arc Latarjet procedure. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2011;27(11):1485-9.
34. Mahmoud HF, Farhan AH, Fahmy FS. Satisfactory functional results and complication rates after anterior glenoid bone block reconstruction in recurrent shoulder dislocation: a mean 4-year follow-up comparative study. Journal of ISAKOS. 2022;7(4):47-53.
35. Mengers SR, Knapik DM, Kaufman MW, Edwards G, Voos JE, Gillespie RJ, et al. Clinical outcomes of the traditional latarjet versus the congruent arc modification for the treatment of recurrent anterior shoulder instability: a meta-analysis. Orthopaedic Journal of Sports Medicine. 2021;9(10):23259671211030204.