

Original article

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Treatment results of a modified Eden-Hybinette technique for anterior shoulder instability

*Resultados del tratamiento de una técnica modificada de Eden-Hybinette para la inestabilidad del hombro anterior*Cortes-De la Fuente AA,* Valencia-Martínez G,[‡] Martínez-Montiel O[§]

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ABSTRACT. Introduction: Glenohumeral instability occurs in active-age patients with high recurrence rates in previously described treatments. The objective of the study was to analyze the functional and radiographic results of the patients that underwent a modified Eden-Hybinette technique. **Material and methods:** From January 2017 to December 2019, 14 patients with post-traumatic anterior glenohumeral instability with glenoid bone loss higher or equal to 15% with or without Hill-Sachs lesion were included, who used the modified Eden-Hybinette technique and outcomes were evaluated with WOSI and ROWE scales pre and post-procedure at 6, 12, and 24 months follow-up, a CT scan was performed at 6 weeks to evaluate the integration of the graft. **Results:** Five women (35%) and nine men (65%) with a mean age of 39.1 ($\pm$ 14) years were included. Ten involved the right shoulder (71.4%) and four the left one (28.5%). The results of WOSI and ROWE scales were statistically significant ($p \leq 0.05$) in postsurgical evaluations as in all periods analyzed in contrast to a pre-surgical standing point; components of the WOSI test were also viewed separately (Sports, Lifestyle, Emotion, and Physical Symptoms) to assess if any of those separately could've altered or significantly influenced the total score obtained, but we found statistical significance ($p \leq 0.05$) in all parameters. There was no recurrence or complications until the last follow-up. **Conclusions:** The modified Eden-Hybinette technique offers good short-term functional

RESUMEN. Introducción: La inestabilidad glenohumeral ocurre en pacientes en edad activa con altas tasas de recurrencia en tratamientos descritos anteriormente. El objetivo del estudio fue analizar los resultados funcionales y radiográficos de los pacientes sometidos a una técnica de Eden-Hybinette modificada. **Material y métodos:** De enero de 2017 a diciembre de 2019, se incluyeron 14 pacientes con inestabilidad glenohumeral anterior postraumática con pérdida ósea glenoidea mayor o igual a 15% con o sin lesión de Hill-Sachs, se utilizó la técnica modificada de Eden-Hybinette y se evaluaron los resultados con las escalas WOSI y ROWE pre y postprocedimiento a los 6, 12 y 24 meses de seguimiento, se realizó una tomografía computarizada a las seis semanas para evaluar la integración del injerto. **Resultados:** Evaluamos cinco mujeres (35%) y nueve hombres (65%) con una edad media de 39.1 ($\pm$ 14) años. Diez involucraron el hombro derecho (71.4%) y cuatro el izquierdo (28.5%). Los resultados de las escalas WOSI y ROWE fueron estadísticamente significativos ($p \leq 0.05$) en las evaluaciones postquirúrgicas como en todos los períodos analizados en contraste con el prequirúrgico. Los componentes de la prueba WOSI también se vieron por separado (deportes, estilo de vida, emoción y síntomas físicos) para evaluar si alguno de ellos por separado podría haber alterado o influido en la puntuación total obtenida, pero encontramos significancia estadística ($p \leq 0.05$) en todos los parámetros. No hubo recurrencia ni complicaciones hasta el último seguimiento. **Conclusiones:** La técnica

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results. It is a safe technique. Further studies are necessary to determine the effectiveness and possible long-term results and complications.

Keywords: Shoulder, instability, surgery, treatment, bone block, results.

Eden-Hybinette modificada ofrece buenos resultados funcionales a corto plazo. Es una técnica segura. Se necesitan estudios adicionales para determinar la efectividad y los posibles resultados y complicaciones a largo plazo.

Palabras clave: Hombro, inestabilidad, cirugía, tratamiento, bloqueo óseo, resultados.

Introduction

Traumatic glenohumeral dislocation is an entity that occurs at a rate of 0.08/1,000 annually, the anterior type being 80.3% of them. Population under 25 years is at particular risk of recurrent instability reported to be as high as 90-95%, Rowe et al. reported 100% of recurrence in children under 10 years, 94% in patients aged 10 to 20 and 79% in patients 20 to 30 years.¹

The Instability Severity Index (ISIS) described by Boileau & Balg, helps us define an algorithm to indicate a bone augmentation procedure beyond a simple arthroscopic repair with a score > 6 points to recommending Latarjet, although Phadnis et al. recommended lowering the cut-off point to 3 and Thomazeau et al to 2, so there are no standard criteria.^{1,2,3,4}

The pathophysiology cascade includes dislocation in anterior direction of the humeral head with Bankart lesion representing an avulsion of the IGHL described by Sugaya et al in shoulders with recurrent dislocation with a 97% incidence and 50% being bony Bankart or a HAGL lesion that occurs approximately in 9% of patients.^{1,3}

The type or amount of glenoid bone loss has a marked effect on the treatment decision and clinical prognosis, Greis et al demonstrated the reciprocal effect of the reduction of the contact joint area with increased contact pressure by 300% in anteroinferior glenoid defects of 30%, moreover, Bukhart and DeBeer described the «inverted pear» shape of the glenoid which has been considered as a risk factor for arthroscopic stabilization failure.¹

Regarding treatment, recurrences of 10% in operative vs 58% conservative treatment have been shown. A recent Cochrane review detailed that conservative treatment leads to glenohumeral arthritis up to 39% in patients with recurrent instability.^{1,5,6} Other papers suggest that glenoid bone losses of less than 20-25% are associated with recurrences of 4.2 to 19% even with surgical treatment but only with arthroscopic soft tissue techniques. For losses greater than 25% of the anteroinferior glenoid, arthroscopic-alone procedures have been associated with dislocations up to 67%, while other authors suggest that deficiencies of > 13.5% predispose to a poor prognosis.^{1,2,7} So, augmentation procedures such as Latarjet with «triple combined effect» has been the gold standard in the past in the context of a critical glenoid bone loss defined as a defect of > 25%. These defects do not occur in isolation

and can be found accompanied by Hill-Sachs lesion in up to 65-67% in the first event and 84-93% in recurrent cases.^{1,8}

Di Giacommo described an algorithm in 2015 where he recommends performing an augmentation procedure in patients with an «on track» Hill-Sachs lesion with glenoid loss of > 20% and a Latarjet in an «off-track» HS with glenoid loss of more than 20%.^{3,8} For augmentation most authors agree on defects of > 25% or more than 6 to 8 mm, others agree that a loss of even 15% would be a good indication for augmentation particularly in patients with recurrent instability. Different reconstructions have been described including the Bristow, Latarjet, the use of autologous iliac crest, femoral head, distal tibia, and clavicle grafts for augmentation.^{2,9,10}

The gold standard for many years has been the Latarjet procedure which, in comparison with the isolated arthroscopic Bankart procedure reports recurrences of 3 vs 28.4%, so there has been an interest in performing this procedure in a primary way for all cases of anterior recurrent dislocations of the glenohumeral joint. It is effective in restoring stability in patients with chronic cases, even in patients with ISIS equal or > 4, and in revision cases for failed Bankart procedures; on the other hand, a Latarjet procedure failure is difficult to manage with recurrences up to 12% after an Eden-Hybinette procedure done patients reporting 33% of poor results.^{4,11}

Griesser et al. described complications up to 30% being neurovascular injury 1.8% moreover Shah et al. reported complications as high as 25% in patients undergoing Latarjet with neurovascular injuries in up to 10%, recurrent instability in 8% and infection in 6%.^{9,11}

Moderate to severe osteoarthritis has been reported in 18% in patients without recurrence and up to 26% in patients treated with Latarjet surgical stabilization.⁵

The Eden-Hybinette procedure with autologous iliac crest graft has shown good results with lower recurrent rates of instability, the present indication for this technique includes severe glenoid bone loss of more than 40%, recurrent instability after a Latarjet or distal tibia graft, but the main problem of this technique is the morbidity of the donor site and the accelerated rate for postoperative glenohumeral arthritis in up to 20%.^{12,13}

Taverna et al. described an arthroscopic technique in 26 patients, reporting 88.5% satisfaction without recurrent dislocations and graft integration of 92.3%.¹²

In the Eden-Hybinette procedure, 17.6% of complications have been described, compared to 17.2% in arthroscopic Latarjet and Bristow-Latarjet in 15%.¹¹

It is in the interest of the leading author to consider his modified technique of Eden-Hybinette using heterologous iliac crest graft as a primary tool procedure for recurrent dislocations. The objective of this study was to describe a modified Eden-Hybinette technique and to analyze the clinical results with WOSI and ROWE scales, and also to see graft integration in patients with anterior recurrent glenohumeral instability and glenoid deficiency equal or greater than 15% with or without HS lesion.

Material and methods

All the patients were informed and consent given for the type of study carried out explaining the risks and benefits of being involved; also, they signed an informed consent which was guided per the Helsinki declaration. The protocol was carried out with the prior authorization of the hospital's ethics committee.

We describe an observational study of 14 patients diagnosed with recurrent post-traumatic glenohumeral anterior instability from January 2017 to December 2019 using the modified Eden Hybinette technique for their treatment.

The sample was made up of five women (35%) and nine men (65%) with a mean age of 35 years (range of 20-68 years), of whom ten had involvement in the right shoulder (71.4%) and four in their left shoulder (28.5%), the dominant side was affected in 11 patients.

The evaluation of the results was carried out based on the functional scales WOSI and ROWE¹⁴, pre- and post-surgical in a follow-up at 6, 12, and 24 months after the initial treatment. Statistical analysis of the results were introduced in the SPSS program and compared by Student's T-test at different times.

In the pre-surgical evaluation, a CT scan was performed and measured by the PICO method¹⁵ then it was directly arthroscopically evaluated during the procedure; post-surgical CT was performed 6 weeks after the procedure and one year after to assess the integration of the graft.

Surgical technique

This was the described previously by the senior author using heterologous iliac crest graft. the patient is placed in a beach chair position with the trunk flexed at 30°, a rigid cervical support is placed as neck protection; Likewise, special support at the forearm is required before performing any arthroscopic portal.

The glenohumeral joint is entered through a posterior portal then an anterior portal is made through direct visualization. The entire joint is explored, and the presence of all lesions are reported with measurement of glenoid bone loss for further comparison with CT scan. After this,

a deltopectoral approach is performed with a longitudinal 5 cm incision is made, an intermuscular plane is developed between the pectoralis major and medial border of the deltoid, rejecting it medially and laterally respectively taking care not to injure the cephalic vein. The conjoint tendon of the coracobrachialis and the short portion of the biceps is located, which will serve as the medial limit during the procedure. Blunt dissection of the subscapularis muscle is performed, making access to the extra-articular anterior portion of the glenoid. We proceed to do a longitudinal capsulotomy and opening the intraarticular space locating the glenoid bone loss; subsequently, the anterior portion of the glenoid is carefully dissected from the periosteum then reaming the exterior surface to promote local bleeding and direct contact with the allograft.

Iliac crest heterologous graft is used with measurements previously determined by CT scan; with a hand saw the graft is countered creating a concave surface that is consistent with the anterior glenoid edge, placement of a 1.0 mm k wire in the upper and lower portion of the graft for temporary fixation is used, then a 2-5 mm drill bit is passed through bone graft and glenoid neck. Cannulated partially thread 3.5 mm screws are placed through the k wire and then removed obtaining final fixation of the graft. Closure of the capsule is performed with 2-0 monocril, then subscapularis muscle is closed with U-stitches, the field is irrigated and then closed by layers with separate stitches, finally, the wound is closed in a subcutaneous manner.

After surgery the patient is allowed to place a universal shoulder immobilizer with a sling for 3 weeks, at the beginning of the fourth-week, pendular and passive range of motion begins. By the sixth week, an active range of motion is allowed and by 4 months, all patients can be reincorporated to their normal activities except for contact sports which should be delayed till six months post-surgery.

Results

Patients had a mean age of 39.5 years (20 to 65) at the time of the intervention, five women (35%) and nine men (65%), ten were involved of the right shoulder (71.4%), and four the left side (28.5%). The etiology was traumatic in all the sample. All the patients had a positive apprehension test, the mean of dislocations was 4.7 (range of 3-9 dislocations).

In the pre-surgical stage the evaluation of glenoid bone loss showed an average of 26% (ranges 18-43%).

Results in the pre-surgical WOSI scale were evaluated with a mean of 1521.93 (SD 66.897) against WOSI means at 6, 12, and 24 months, 1187.57 (SD 226.713), 806.50 (SD 104.605) and 549.07 (SD 151.967) respectively.

The data of the WOSI score variables were also analyzed separately as shown in the [Table 1](#).

In the pre-surgical ROWE scale, we obtained a mean of 35.36 (SD 7.459) which was compared against the same scale at 6, 12, and 24 months with means of 64.64 (SD 6.033), 85.36 (SD 7.958) and 94.64 (SD 3.650) respectively.

Table 1: Specific variables of the Western Ontario Shoulder Instability Index score.

	Mean dif.	95% Confidence interval	
		Inferior	Superior
WOSI.Sports_pre	325.071	315.25	334.90
WOSI.Sports_6*	253.857	222.42	285.30
WOSI.Sports_12*	159.857	145.31	174.41
WOSI.Sports_24*	105.571	84.09	127.06
WOSI Lifestyle Pre	293.714	281.25	306.18
WOSI Lifestyle 6*	236.429	209.89	262.97
WOSI Lifestyle 12*	158.071	143.31	172.83
WOSI Lifestyle 24*	109.143	87.65	130.64
WOSI Emotion Pre	251.571	240.26	262.88
WOSI Emotion 6*	169.357	139.93	198.78
WOSI Emotion 12*	109.357	95.85	122.87
WOSI Emotion 24*	72.143	56.06	88.22
WOSI Score Pre	1,521.929	1,483.30	1,560.55
WOSI Score 6*	1,187.571	1,056.67	1,318.47
WOSI Score 12*	806.500	746.10	866.90
WOSI Score 24*	549.071	461.33	636.81
WOSI Physical Symptoms Pre	651.571	620.59	682.56
WOSI Physical Symptoms 6*	535.071	477.80	592.35
WOSI Physical Symptoms 12*	379.214	352.52	405.90
WOSI Physical Symptoms 24*	262.214	227.62	296.81

* Months.

The distribution of the data that was analyzed on both scores is shown in [Figures 1 and 2](#).

Statistical analysis was carried out with the SPSS program and using Student's t-test for related samples, obtaining the following results comparing the means of the results of the WOSI pre-surgical scale vs. the mean of the scale at 6, 12 and 24 months obtaining a significant value ($p \leq 0.05$); Besides, the analysis was carried out separately (Sports, Lifestyle, Emotion and Physical Symptoms) to assess if any would have significantly influenced the final score obtained. They all resulted in a significant value ($p \leq 0.05$).

Likewise, the mean of the pre-surgical score on the ROWE scale was compared against the means at 6, 12 and 24 months, finding a statistical significance ($p \leq 0.05$).

There were no postoperative complications, infection or graft failure, and we had zero recurrence of dislocation at 2-years follow-up.

Discussion

The strength of the study lies in having a prospective analysis with a 2-year follow-up of a modified surgical technique to reduce the complications described in the literature with a lower cut off value for the procedure indication described before for patients with recurrent glenohumeral instability without previous surgeries.

The treatment of choice for recurrent instability continue to be at debate, but favoritism has been shown for the Latarjet procedure. Some series have reported low recurrence of instability after treatment with Latarjet, which has been the gold standard of choice with rates from 0 to 8% and 28.4% performing arthroscopic Bankart alone.^{1,4} Our sample had no recurrences rates at the last follow-up (2 years).

The initial indication for an Eden-Hybinette technique in the literature was described in the context of glenoid bone loss of 40% or greater in addition to recurrent instability after a Latarjet technique or distal tibial graft. Taverna et al. described that arthroscopic technique alone had 88.5% satisfaction in patients without dislocations and 92.3% of graft integration, being the main complication, morbidity of the donor site.¹²

With our technique, complication of the donor site is eliminated and we found in the sample an adequate integration of the graft according to that described in the literature. Three series with arthroscopic Latarjet reported complications in up to $19.8 \pm 5.6\%$ with no union observed in $8.1 \pm 4.1\%$ and graft osteolysis in $4.1 \pm 2.6\%$.

Muizumo et al. in a 20-year follow-up, indicates arthritis rates up to 23.5% for Latarjet. The Eden-Hybinette procedure has described acceleration of arthrosis in up to 20%.^{1,12} It would be interesting to investigate this population with longer follow-up since we performed the

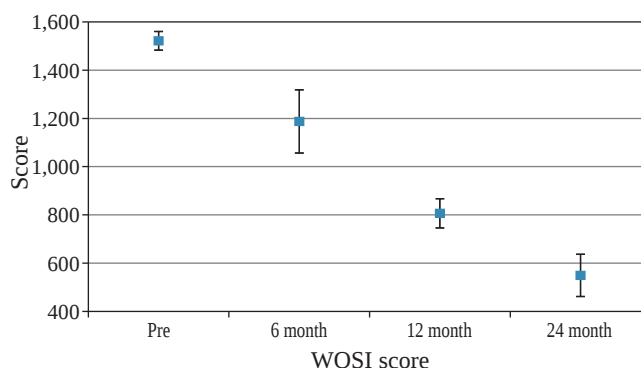


Figure 1: Pre-surgical western ontario shoulder instability index score vs 6, 12, and 24 months.

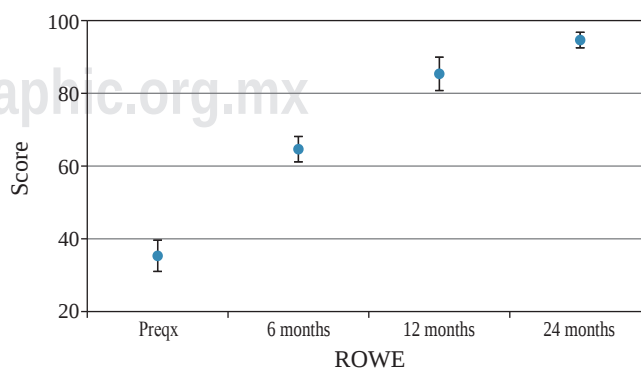


Figure 2: Pre-surgical Rowe scale vs 6, 12, and 24 months.

cut off at 2 years and at the moment no arthritic changes were observed, although the cause has not been clearly described.

Eden-Hybinette technique has approximately 17.6% of complications described, compared to 17.2% of the arthroscopic Latarjet and Bristow-Latarjet in 15%.¹¹ In our sample till the last follow up no complications were observed.

A Neer 2019 award winning study compared Latarjet vs autologous iliac crest graft for treatment of anterior instability with glenoid loss, which included patients with recurrent dislocations defined as more than 2 and bone loss greater than 15% measured by PEAK, in which they found a WOSI and ROWE scale without significant differences and no difference in abduction and external rotation at 6 and 12 months but a clear advantage at 24 months favoring the iliac crest graft.

An increased capacity in internal rotation with significant values in the group of iliac crest graft in the entire follow-up was also noted. No dislocations in both groups, differences in pain or satisfaction in both groups.

Our study is comparable to the results shown here with preserved function and patient satisfaction with WOSI and ROWE resulting in statistical significant values, and the advantage by eliminating the donor site factor which in their study represented 26.7% of complications using that technique.¹⁶

The weakness of the study is not having a comparable population and a small sample.

The modified Eden-Hybinette open technique with heterologous graft can successfully restore stability and function in more than 95% of patients with significant glenoid bone defects with or without Hill Sachs lesion and in worst scenarios of recurrent dislocations adding the advantage of eliminating the morbidity of the donor site.

Furthermore, we believe that it can be taken in account as a primary or first choice option to treat recurrent anterior glenohumeral instability and not only in cases of revision or with glenoid defects greater than 40%.

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