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Title: Outcomes of capsulolabral reconstruction for posterior
shoulder instability

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1 **Original article**
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3 Outcomes of capsulolabral reconstruction for posterior shoulder instability
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14 In the context of the 2016 symposium of the SFA
15

Abstract

Surgical treatment of isolated posterior shoulder instability—a rare and often misdiagnosed condition—is controversial because of poor outcomes.Failure of physical therapy in symptomatic young athletes requires capsulolabral reconstruction or bone block procedures. The goal of this study was to report the outcomes of patients who have undergone surgical capsulolabral reconstruction and to look for risk factors that contribute to failure of this procedure.

We analyzed the outcomes of 101 patients who underwent capsulolabral reconstruction: 83 included retrospectively, 18 included prospectively. The procedures were performed alone or in combination with capsular shift, labral repair, closure of the rotator interval and notch remplissage. The primary endpoint was failure of the procedure, defined as recurrence of the instability and/or pain. We also determined the outcomes based on specific (Walch–Duplay, modified Rowe) and non-specific (Constant, resumption of activities) scores of shoulder instability.

The results were satisfactory despite a high failure rate: 35% in the retrospective cohort with 4.8 ± 2.6 years' follow-up and 22% in the prospective cohort with 1.1 ± 0.3 years' follow-up. The various outcome scores improved significantly. Ninety-two percent of patients returned to work and 80% of athletes returned to their pre-injury level of sports. Eighty-five percent of patients were satisfied or very satisfied after the surgery. No risk factors for failure were identified; however, failures were more common in older patients, those who underwent an isolatedprocedure and those who had unclassified clinical forms.

Treatment of posterior shoulder instability by capsulolabral reconstruction leads to good clinical outcomes; however the recurrence rate is high.

Level 4 – Retrospective study

Keywords: Shoulder instability, posterior, capsulolabral reconstruction

Introduction

Treatment of posterior shoulder instability continues to be challenging. This is a rare condition that makes up 2% to 10% of shoulder instability cases [1, 2] and mainly affects young, male athletes [3, 4]. The main risk factors for recurrence [4] are being less than 40 years of age, suffering from epilepsy and having a humeral notch volume greater than 1.5 cm^3. Surgical techniques to enhance shoulder stability have improved with the development of arthroscopy [5-8]. They are now more reproducible and have limited complications related to posterior shoulder approaches [9, 10].

Surgical techniques for posterior instability resemble those for anterior instability but the published outcomes are not as good [3, 11]. The diagnosis can be difficult to make as other injuries may be present concurrently in the shoulder. These must be ruled out, otherwise the treatment provided will be inappropriate, potentially leadingto poor outcomes[12].

There are no large published French studies on the outcomes after surgical capsulolabral reconstruction for isolated posterior shoulder instability. Large studies from theUnited States [7, 13, 14] focus on athletes involved in pitching sports.

Clinical examination must discover four main criteria to define instability: unidirectional posterior subluxation [15], voluntary or involuntary and reproducible [14], presence of hyperlaxity and adefined injury event. A full imaging work-up consisting of X-rays, CT scan or MRI with injection is needed to identify bone, capsule and labrum injuries. It will also reveal any cartilage damage that may be contributing to the pain, which often occurs with instability [7].

The goal of this study was to determine the outcomes of patients who have undergone isolated soft tissue procedures (labral repair, capsular reconstruction and/or tendon/ligament repair) as a treatment for isolated posterior shoulder instability and to identify risk factors for failure. We hypothesized the best results would be obtained in athletic patients who have involuntary post-traumatic instability without associated bone damage.

Material and methods

In the context of a symposium of the SFA (Francophone Society of Arthroscopy) on posterior shoulder instability, we included 202 patients treated for isolated posterior shoulder instability at 11 hospitals.The cohort consisted of 150 patients included retrospectively and 52 patients included prospectively.

Inclusion criteria were the presence of unidirectional posterior instability, with or without pain, surgical treatment on the soft tissues and at least 1 year of follow-up. Patients were excluded if they had undergone a bone block procedure (15 in the prospective cohort and 66 in the retrospective cohort), if they had not been treated surgically (19 in the prospective cohort), had a psychological condition related to the instability, or had posterior subluxation with osteoarthritis or chronic dislocation.

The procedures performed consisted of capsular shifting (10 in the retrospective cohort and 3 in the prospective one), capsulolabral reconstruction (6 in the retrospective cohort and 1 in the prospective one) as described by Bradley et al. [15] or a combination of both (62 in the retrospective cohort and 13 in the prospective cohort) with associated rotator interval closure in select cases (8 in retrospective cohort). For 7 patients in the retrospective cohort and 3 in the prospective cohort, anterior notchremplissage was performed alone or in combination with other procedures.

Data were collected from the preoperative records and at the last follow-up for patients in the retrospective cohort. For the patients in the prospective cohort, data were collected

94 before the surgery and then at 6 and 12 months' post-operative. The clinical outcomes
95 consisted of specific (Walch–Duplay, modified Rowe) and non-specific (VAS for pain,
96 Constant, Subjective Shoulder Value) scores of shoulder instability. Every patient also
97 underwent X-rays and CT arthrography or MRI to look for capsule, labrum and bone damage.
98
99 Patients were placed in one of four groups, depending on the clinical presentation:
100 - Involuntary for patients with instability secondary to a defined injury event, without
101 reproducible or voluntary dislocation
102 - Voluntary for patients with reproducible voluntary instability, typically without a defined
103 injury event, but with inherent hyperlaxity
104 - Voluntary to involuntary for patients with voluntary instability initially who suffered an
105 injury leading to loss of control over their instability, which is now symptomatic
106 - Pain for patients who complain of pain with anatomical posterior instability lesions
107
108 　　　The primary endpoint was the occurrence of failure, defined as recurrence of the
109 instability with dislocation or subluxation and/or pain. The secondary endpoints were the
110 Walch–Duplay and modified Rowe shoulder specific scores [16, 17], visual analog scale
111 (VAS) for pain, subjective shoulder value (SSV) and Constant scores. Patient satisfaction was
112 graded as very satisfied, satisfied, somewhat satisfied and disappointed. Return to work and
113 resumption of sports were also recorded.
114
115 *Statistical analysis*
116 　　　Descriptive statistics were used to summarize the data. The normality of the
117 distributions was verified using the Shapiro-Wilk test. Differences between mean values were
118 tested using Student's *t*-test or the Mann-Whitney test if the data were not normally
119 distributed. The relationship between categorical variables was analyzed with a Chi-square
120 test. Statistical tests were performed with the statistical package, R version 3.3.3 (R
121 Foundation, Vienna, Austria). A *P*-value of 0.05 or less was considered as statistically
122 significant.
123
124
125 **Results**
126
127 　　　In the retrospective cohort, 83 patients (55%) underwent soft tissue procedures; 18
128 patients (35%) did so in the prospective cohort. These two groups were comparable in terms
129 of age, sex, sports level, dominant side involvement, glenoid bone damage detected on
130 imaging; however the breakdown of clinical forms defined for the symposium differed
131 between groups (Table 1). The procedures performed in each cohort are shown in Figures 1
132 and 2. Resorbable suture anchors were used in most cases – 3 on average. Postoperatively,
133 immobilization in neutral rotation was used in 75 patients (74%) for an average of 5 weeks
134 with rehabilitation starting after the 3rd week.
135 　　　The mean follow-up in the retrospective cohort was 4.8 ± 2.6 years and 29 patients
136 (35%) were considered failures: 7 cases of recurrent dislocation, 12 of recurrent subluxation
137 and 10 of constant pain. TheWalch–Duplay score was 75.9 ± 26.7 and the modified Rowe
138 score was 80.3 ± 23.6 at the most recent follow-up. The VAS, SSV and Constant scores had
139 also improved (Table 2). Sixty-five patients agreed to be re-operated, while 80% of patients
140 were very satisfied (n=44) or satisfied (n=22) (Fig. 3). Seventy-six patients (92%) returned to
141 work after an average of 5.5 months. Fifty-two patients (63%) resumed their sports
142 participation and 16 patients (80%) were at their pre-injury level after an average of 7.6
143 months.

144   The highest outcome scores were in the involuntary instability group(Table 3). There
145 were no significant differences in the surgical technique used; however isolated procedures
146 were more common in the subset of patients considered as failures. No significant correlation
147 was found in the subset of patients considered as failures (Fig. 4).
148   The mean follow-up in the prospective cohort was 1.1 ± 0.3 years; the outcomes were
149 similar to those found in the retrospective cohort. Four patients (22%) were considered as
150 failures: one case of recurrent subluxation and three of constant pain. The Walch–Duplay
151 score improved by 43.5 ± 27.4 points and the modified Rowe score by 55.9 ± 27.6 points.
152 Pain on the VAS was reduced by 2.4 points; the SSV improved by 27 points and the Constant
153 score by 16.7 points (Table 4). Given the small cohort, no statistical analysis was performed.
154   No complications related to the hardware were found in either group. We did not come
155 across more postoperative stiffness in patients who underwent rotator interval closure or notch
156 remplissage. There were no neurological complications in the eight patients (six in
157 retrospective cohort and two in prospective cohort) who underwent an open procedure.
158
159 **Discussion**
160
161   The shoulder specific and non-specific outcome scores were good after capsulolabral
162 reconstruction for posterior shoulder instability; however the failure rate was high. The rates
163 of return to work (92%) and resumption of competitive sports (80%) were high. We did not
164 find any significant difference in the outcome based on the various surgical techniques used,
165 nor the various clinical presentations.
166   Analysis of the failure cases revealed this subset of patients was older than the non-
167 failures cases (31.8 years versus 27.4 years). The breakdown of patients into various clinical
168 forms also differed, with the failure cases having fewer patients fromthe involuntary group
169 and more from the unclassified group (patients which did not fit in one of the four groups
170 defined for this study (Figure 4)).Our study confirmed that combined reconstruction with
171 capsular shift procedures resulted in less failures than isolated capsular shift as suggested by
172 Bradley et al [13]. However, these differences were not statistically significant, likely due to
173 the small number of patients in these subgroups. The small number of patients in the cohorts
174 makes it impossible to identify risk factors for failure, no matter which surgical technique was
175 used, clinical presentation or associated factors (bone damage, age, competitive sports).
176   The 2015 review of literature published by DeLong et al. [3] suggested better
177 outcomes for arthroscopic techniques than open procedures during posterior shoulder
178 stabilization. We did not specifically evaluate this point in our study as only eight patients
179 underwent an open procedure. Their meta-analysis found a recurrence rate of 8.1% for all
180 techniques combined with persistent pain in 12.3% of patients. The failure rate in our study,
181 which took into account recurrence of the subluxation or dislocation along with constant pain,
182 was higher than in large, recently published prospective studies [13, 18]. This higher rate can
183 be attributed to the broad definition of failure in our study (all patients who had recurrent
184 dislocation, subluxation or constant pain) compared to other studies in which failure is
185 defined relative to specific outcome scores, independently of the recurrence of subluxation or
186 pain [3, 7, 13, 14].
187   In our large retrospective cohort, the high failure rate (35%) must be placed in the
188 context of the high patient satisfaction rate (80%) and the high portion of patients returning to
189 work (92%) and resuming their sports (80% for competitive athletes). This is likely due to the
190 difference in patients' expectations and the strict failure criterion used in our study. If failure
191 had been defined as the recurrence of instability or pain in patients who were not satisfied or
192 did not improve, the overall failure rate would be reduced from 31.7% to 13.4% with all
193 treatments combined.

194   In the prospective study, the findings were similar but the failure rate lower. The
195 primary reason for failure was the development of postoperative pain; there were few
196 recurrences of the instability. The small number of patients included and the shorter follow-up
197 did not allow us to extensively analyze these findings. In the patients with chronic instability,
198 persistent pain outside instability episodes was—in some cases—related to cartilage damage
199 that could not be addressed surgically.
200   Despite the bone damage over the posterior glenoid found in 33% of patients (Table
201 1), this subset of patients did not experience more failures following surgical treatment of soft
202 tissues. Nevertheless, the extent of bone damage was not quantified. Bone damage is likely
203 the best indication for a bone block procedure. Up to now, no study has looked at the extent of
204 bone loss as an indication for bone block procedures in posterior instability [19]. A
205 prospective study comparing these two techniques based on the extent of bone damage would
206 allow us to better define the indications.
207   The small number of patients who underwent rotator interval closure and notch
208 remplissage in combination with the capsule procedures did not allow us to identify risk
209 factors specific to these techniques. Nevertheless, the outcomes were not superiornor did
210 more complications occur when these procedures were performed. Postoperative stiffening
211 reported in some studies after interval closure[20] was less for arthroscopic procedures than
212 open ones because of superoinferior closure instead of mediolateral, which can explain our
213 observations. To determine the impact of these associated procedures, a larger study is needed
214 that takes into account the preoperative lesions and compares these various procedures in a
215 prospective, randomized manner.
216
217

218 **Conclusion**
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220   Treatment of posterior shoulder instability by capsulolabral reconstruction leads to
221 good clinical outcomes; however the failure rate was high based on our stringent criteria. The
222 indication is most appropriate in young athletes with a clinical involuntary instability. The
223 presence of small bone lesions on the glenoid side is not a contraindication to this type of
224 treatment. The surgical procedure must combine capsular shifting with labral repair and
225 potentially interval closure or notch remplissage.
226

226
227 **Figure legends**
228
229 Figure 1: Types of procedures performed to treat posterior shoulder instability in the
230 retrospective cohort
231 Figure 2: Types of procedures performed to treat posterior shoulder instability in the
232 prospective cohort
233 Figure 3: Patient satisfaction in the entire cohort
234 Figure 4: Breakdown of clinical forms and age of the patients defined as failed cases versus
235 non-failures

236
237 Table 1: Preoperative characteristics of patients in the retrospective and prospective cohorts
238

Cohort description	Retrospective (n = 83)	Prospective (n = 18)
Age (years ± SD)	28.9 ± 9.2	28.3 ± 10.6
Sex (male ratio)	59 (71%)	16 (89%)
Dominant side involved	54 (65%)	8 (44%)
Athletes	62 (75%)	11 (61%)
Competitive	20 (24%)	4 (22%)
Defined injury event	62 (75%)	17 (94%)
Involuntary	40 (48%)	14 (78%)
Voluntary	3 (4%)	0
Voluntary to involuntary	10 (12%)	2 (11%)
Painful	20 (24%)	2 (11%)
Unclassified	10 (12%)	0
Bone damage on CT scan (glenoid/humeral side)	28 (34%) / 16 (19%)	6 (33%) / 6 (33%)

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242 Table 2: Non-specific outcome scores in the retrospective cohort
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Non-specific scores	Preoperative*	Postoperative*
Pain (VAS)/10	5.6 ± 2.4 (34)	2.4 ± 1.8 (68)
SSV/100	50.9 ± 21.6 (33)	84.2 ± 19.1 (71)
Overall Constant score	73.2 (42)	85.2 (76)
Pain	6.6	12.3
Function	13.4	17.4
Mobility	36.9	37.3
Strength	15.6	18.1

244 * Mean ± SD (n counts); VAS: visual analog scale, SSV: Subjective Shoulder Value
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255   Table 3: Outcomes based on the clinical presentation (except voluntary group)
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	Involuntary (n=40)	Painful (n=20)	Voluntary to involuntary (n=10)	Unclassified (n=10)
Overall Constant score	88.7	84.8	90.7	63.7
Pain	13.2	11.7	12.2	9.9
Mobility	38.5	37.2	39.3	30.8
Function	18.4	17.5	18.2	12.6
Pain (VAS)/10	1.0	2.2	3.3	2.5
SSV/100	87.0	82.5	87.1	69.4

257   VAS: Visual Analog Scale, SSV: Subjective Shoulder Value (n = number of patients in each
258   group)
259
260
261   Table 4: Outcomes in the prospective cohort
262

Non-specific scores	Preoperative*	Postoperative*
Pain (VAS)/10	4.47 ± 2.7	2.39 ± 3.5
SSV/100	59.7 ± 18.4	87.1 ± 18.5
Overall Constant score	70.4 ± 18.4	87.1 ± 16.7
Pain	8.1	12.7
Function	11.8	17.3
Mobility	34.7	37.3
Strength	15.8	19.8
Walch-Duplay score /100	40.89 ± 21.8	85.3 ± 19.1
Modified Rowe score/100	33.5 ± 20.4	90 ± 18.3

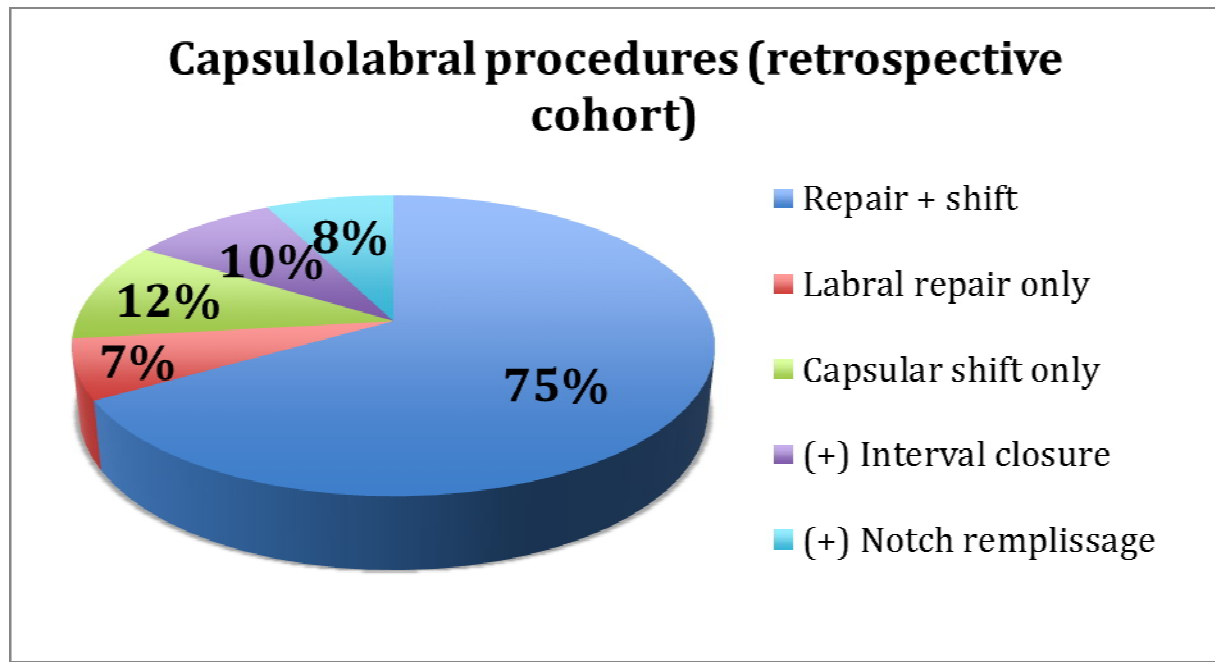263   * Mean ± SD; VAS: visual analog scale, SSV: Subjective Shoulder Value
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266   **Conflict of interest: none**

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268   References
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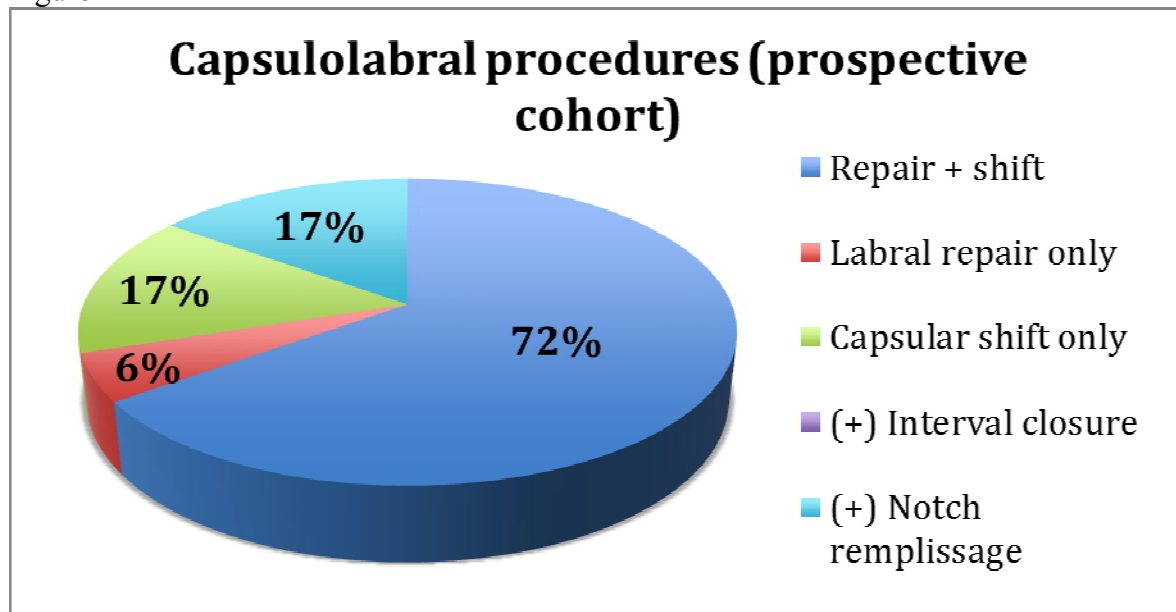330   2014;22:48-57.
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334   Figure 1
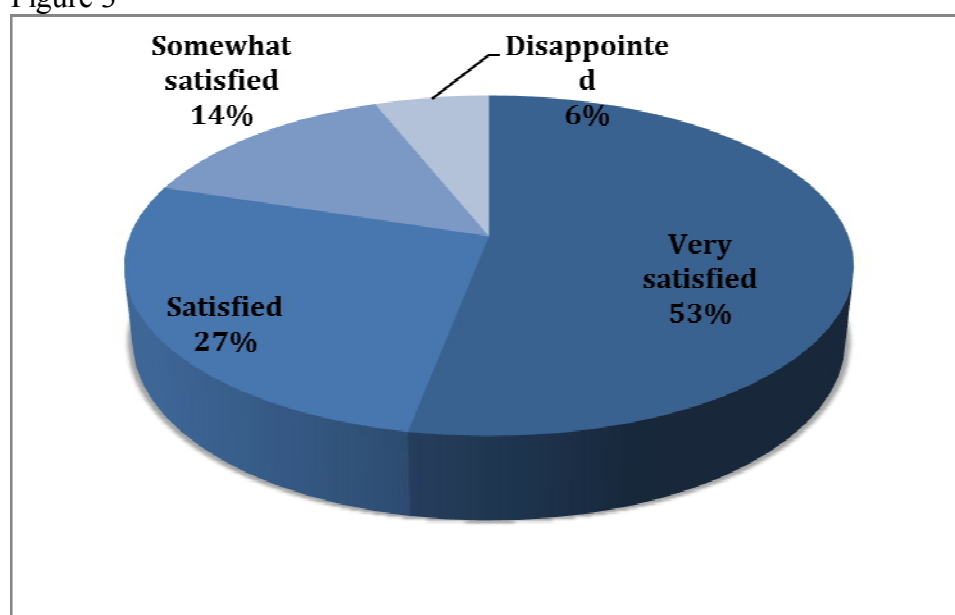335

335
336   Figure 2

Capsulolabral procedures (prospective cohort)

- Repair + shift
- Labral repair only
- Capsular shift only
- (+) Interval closure
- (+) Notch remplissage

17%
17%
6%
72%

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340   Figure 3

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345   Figure 4
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