Interest of emergency arthroscopic stabilization in primary shoulder dislocation in young athletes

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ABSTRACT

Introduction: The recurrence rate after primary shoulder dislocation in young subjects with high functional demand is close to 75%. The present study assessed the interest of emergency arthroscopic stabilization in this specific population.

Material and methods: A non-randomized prospective study included 31 athletes under 30 years of age with primary anterior shoulder dislocation. Fifteen were offered emergency stabilization; after informed consent, 14 were enrolled in the “emergency stabilization” group. This was compared to a group matched for age, sport and lesion, managed 1 year previously by “non-operative” treatment (n = 17), divided into 2 subgroups: ”immobilization” and “secondary stabilization”. Continuous prospective assessment of recurrence, return to sport and function (QuickDASH, QD sport, Duplay and Rowe scores) enabled comparison between the 3 groups.

Results: Mean follow-up was 19 months for the “emergency stabilization” group and 25 months for the “non-operative” group. There were no failures in the “emergency stabilization” group, compared to a 77% rate in the “non-operative” group with onset at a mean 7.5 months and a mean 2.6 episodes of recurrence. Seven (54%) of the failures of non-operative treatment required secondary stabilization. Ninety-three percent of the “emergency stabilization” group, 44% of the “immobilization” group and 71% of the “secondary stabilization” group resumed sport at least at their pre-dislocation level. Mean Quick DASH was 1.46 in the “emergency stabilization” group, versus 15.28 the “immobilization” group (P<0.05) and 16.96 in the “secondary stabilization” group. Mean Duplay and Rowe scores were respectively 92.9 and 95 in the “emergency stabilization” group, versus 59.44 and 61.1 in the “immobilization” group (P<0.05) and 85 and 93.57 in the “secondary stabilization” group.

Discussion: Emergency arthroscopic stabilization limits recurrence (Kirkley et al.), with better functional results than for secondary stabilization, lesion “freshness” providing a more favorable environment for labral and ligamentary healing. These encouraging results need confirmation over longer follow-up.

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1. Introduction

After reduction, anterior shoulder dislocation is traditionally managed conservatively, with immobilization of varying duration according to the school of thought. Although immobilization is meant to allow ligament healing, recurrence rates are in fact high, especially in young (<30 years) active patients, ranging from 13% to 96% depending on the series [1–6].

Risk factors for chronic shoulder instability are now well-identified, age and sports practice being the main two [7–10].

The younger the age at primary dislocation, the higher the risk of recurrence [8,11], while recurrence is directly related to sports practice. Certain authors also implicate gender, male subjects being at greater risk than females [11,12]. Each episode of instability involves functional impairment and thus a time cost in terms of sport and work [13–16].

Classically, surgery is reserved for chronic instability. Results with the arthroscopic Bankart repair have progressively improved with developments in technique and implants. Although a justifiable attitude, it still has a high rate of associated recurrence: 10–30%, depending on the series and follow-up [17].

Ligament reinsertion makes sense only if performed within weeks of trauma; later healing seems improbable. The present study therefore assessed rates of recurrence and functional

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recovery after arthroscopic stabilization in young athletes treated on a semi-emergency basis after a first episode of anterior shoulder dislocation.

2. Material and methods

A non-randomized prospective comparative study was performed over a period of 6 months (March–November 2011) in a university hospital centre. Athletes under the age of 30 years with radiologically demonstrated primary anterior shoulder dislocation were included. Exclusion criteria were history of instability or pain in the involved limb, discovery of a bone lesion (glenoid or humeral head fracture) or humeral avulsion of the glenoid ligament (HAGL), and vasculo-neural impairment persisting after reduction. Patients who declined surgery or could not ensure at least 2 years’ regular follow-up were also not included.

The dislocation was reduced by external maneuver (Milch maneuver) [18] after administration of simple steps 1 and 3 analgesia. The patient was then immobilized in an orthopaedic brace in internal rotation and re-examined within 48 hours. The risks of recurrence and complications inherent to each treatment modality (non-operative or surgical) according to the literature were explained clearly and appropriately. The choice of treatment was left up to the patient after 48 hours’ reflection, during which arthro-CT was performed.

Surgery was performed within 2 weeks of primary dislocation, by a single senior surgeon. Stabilization was achieved by isolated arthroscopic Bankart repair. Under general anaesthesia and interscalene block, the patient was positioned in a beach-chair and the shoulder was tested to assess the degree and direction of laxity under anaesthesia. The upper limb was then placed in 2–3 kg traction at 30° anterior elevation. A classic posterior “soft-point” approach was performed to introduce the arthroscope to explore the joint lesion and evacuate the hematoma. Lesions discovered were recorded for comparison with arthro-CT findings. Two outside-in anterior approaches (antero-superior and antero-inferior) were performed under arthroscopic control (Fig. 1). A cannula was introduced through the antero-inferior approach, which was the main instrumental approach for anchoring and suturing. The antero-superior approach was supplementary, for traction forceps and TOTS (temporary outside traction suture) [19]. As the lesion was fresh, no release or glenoid freshening was necessary. Depending on the degree of labral detachment, 2 or 3 screwed metal anchors (Stryker®) were inserted on the antero-inferior quadrant of the glenoid rim (Fig. 2). After labro-ligamentous tensioning by traction forceps or TOTS via the supplementary approach, the labrum was fixed to the glenoid cavity by non-resorbable suture to the previously positioned anchors (Fig. 3). The suture was passed through the labrum using a Stabili-Hook suture-passer (Stryker®) (Fig. 4). This step was performed with special care not to induce excessive tension in the anterior capsule/ligament system, which would cause postoperative stiffness in external rotation. Patients were then immobilized in internal rotation elbow-to-body by an orthopedic brace for 4 weeks.

Operated patients were compared to a group matched for age, gender and sports activity, managed non-operatively for primary anterior shoulder dislocation, included retrospectively in the same university hospital centre over a 6-month period (March–November 2010). Patients who had failed to adhere to a minimum 3 weeks’ immobilization or to the post-immobilization rehabilitation program were excluded. Immobilization was in internal rotation elbow-to-body in an orthopedic brace. Some of these patients had undergone secondary stabilization surgery for chronic instability, so that 2 subgroups could be distinguished:

- “immobilization” without surgery;
- “secondary stabilization”.

![Fig. 1. Arthroscopy approaches.](image1)

![Fig. 2. Anchor positioning and sutures anchored in glenoid cavity.](image2)
After 4 weeks' immobilization in internal rotation, all patients (whether managed non-operatively or surgically) underwent the same rehabilitation program:

- **week 4:**
  - passive exercises to recover ranges of motion,
  - active mobilization,
  - no external rotation or return to play,
  - return to work;
- **week 8:**
  - passive exercises to recover ranges of motion,
  - unrestricted active mobilization,
  - muscle chain reinforcement and balance;
- for non-operated patients: return to play at 2 months;
- for operated patients:
  - month 3: return to play without contact or overhead movement;
  - month 4: unrestricted return to play.

The prospective follow-up of the surgery patients was performed by an independent assessor at 1, 2, 3 and 6 months then 1 and 2 years post-surgery. Clinical assessment comprised the QuickDASH work and sports module [20] and Walch–Duplay score. Last (2-year) follow-up included Rowe score [21], Simple Shoulder Test (SST) [22] and the “3S" satisfaction score after stabilization [23]; shoulder proprioception was assessed as the ability to reproduce a posture using a laser pointer on a wall-mounted target [24] (Fig. 5) and the Shoulder HyperAbduction Radiological Test (SHART) [25] (Fig. 6) was administered.

Retrospective follow-up of non-operatively managed patients was performed by the same independent assessor at a mean 25 months (range, 21–29 months), comprising the QuickDASH work and sports module, Walch–Duplay score, Rowe score and SST.

Fig. 3. a: final aspect of repaired labrum (bump effect); b: postoperative radiograph.

Fig. 4. Passage through labrum and descent of knots fixing labrum to glenoid cavity.

Fig. 5. Proprioception test.
Treatment failure was defined as true recurrence, episodes of subluxation or unstable painful shoulder (UPS) preventing return to play.

Recurrence rates were compared on Chi² test, mean functional scores on Student t-test and proprioception on the matched pairs test.

3. Results

Fourteen of the 15 patients underwent emergency stabilization and were prospectively followed up for 2 years, 1 patient having refused surgery. None were lost to follow-up. Mean time to surgery was 7.6 days (range, 2–15 days). Labro-ligamentous reinsertion used a mean 2.6 anchors (range, 1–3).

Nineteen non-operatively managed patients were included; 2 were lost to follow-up. Thus 17 immobilized patients were assessed at a mean 25 months’ follow-up (range, 21–29 months).

Table 1 presents data for the 2 groups.

None of the “emergency stabilization” patients showed recurrence or subluxation or UPS; i.e., failure rate of 0%. One patient was positive on the apprehension test on clinical examination, but had no shoulder-related complaints in sport or work (soldier).

Twelve of the “conservative” patients (71%) showed at least 1 episode of true recurrence, with a mean 2.58 episodes (range, 1–8), at a mean 7.5 months (range, 1–18 months) after primary dislocation. There was 1 case of UPS (6%). In all, there were 13 failures (77%). One patient underwent stabilization 6 months after primary dislocation without having shown recurrence, subluxation or pain.

The difference in failure rates between the surgical (0%) and non-operative groups (77%) was statistically significant ($P < 0.01$).

Seven of the 13 cases of failure of non-operative treatment (54%) underwent secondary stabilization for chronic shoulder instability. Two non-operative subgroups were thus distinguished: “immobilization” and “secondary stabilization” (Fig. 7).

Tables 2–5 present postoperative functional scores.

<table>
<thead>
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<th>Table 1 Patient data.</th>
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<tr>
<td>Surgical treatment</td>
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<tr>
<td>Non-operative treatment</td>
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<tr>
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<td>Gender</td>
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<td>Female</td>
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<td>Sports level</td>
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<td>Regional</td>
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<tr>
<td>National</td>
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<tr>
<td>Dominant side involvement</td>
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<tr>
<td>ISIS score</td>
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</table>
QuickDASH scores were significantly better in the “emergency stabilization” group than in immobilization or secondary stabilization ($P<0.05$).

Both emergency and secondary stabilization patients had better instability scores than with immobilization.

**Table 2**
Comparison of QuickDASH scores.

<table>
<thead>
<tr>
<th></th>
<th>Emergency stabilization</th>
<th>Immobilization</th>
<th>Secondary stabilization</th>
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<tbody>
<tr>
<td>QuickDASH</td>
<td>1.46 (0–4.55)</td>
<td>5.3 (0–11.4)</td>
<td>5.2 (0–11.4)</td>
</tr>
<tr>
<td>QuickDASH work</td>
<td>2.68 (0–6.25)</td>
<td>8.75 (0–18.75)</td>
<td>8.33 (0–25)</td>
</tr>
<tr>
<td>QuickDASH sport</td>
<td>1.34 (0–6.25)</td>
<td>15.28 (0–37.5)</td>
<td>16.96 (0–75)</td>
</tr>
</tbody>
</table>

**Table 3**
Comparison of Walch–Duplay scores.

<table>
<thead>
<tr>
<th></th>
<th>Emergency stabilization</th>
<th>Immobilization</th>
<th>Secondary stabilization</th>
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</thead>
<tbody>
<tr>
<td>Walch–Duplay score</td>
<td>92.9 (70–100)</td>
<td>59.44 (40–100)</td>
<td>85 (55–100)</td>
</tr>
<tr>
<td>Excellent</td>
<td>86% (12/14)</td>
<td>11% (1/9)</td>
<td>71% (5/7)</td>
</tr>
<tr>
<td>Good</td>
<td>7% (1/14)</td>
<td>11% (1/9)</td>
<td>–</td>
</tr>
<tr>
<td>Moderate</td>
<td>7% (1/14)</td>
<td>11% (1/9)</td>
<td>29% (2/7)</td>
</tr>
<tr>
<td>Poor</td>
<td>–</td>
<td>67% (6/9)</td>
<td>–</td>
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**Table 4**
Comparison of Rowe scores.

<table>
<thead>
<tr>
<th></th>
<th>Emergency stabilization</th>
<th>Immobilization</th>
<th>Secondary stabilization</th>
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</thead>
<tbody>
<tr>
<td>Mean Rowe score</td>
<td>95 (75–100)</td>
<td>61.1 (25–100)</td>
<td>93.57 (75–100)</td>
</tr>
<tr>
<td>Excellent</td>
<td>86% (12/14)</td>
<td>11% (1/9)</td>
<td>86% (6/7)</td>
</tr>
<tr>
<td>Good</td>
<td>14% (2/14)</td>
<td>33% (3/9)</td>
<td>14% (1/7)</td>
</tr>
<tr>
<td>Moderate</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Poor</td>
<td>–</td>
<td>56% (5/9)</td>
<td>–</td>
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**Table 5**
Comparison of SST and 3S scores and loss of external rotation.

<table>
<thead>
<tr>
<th></th>
<th>Emergency stabilization</th>
<th>Immobilization</th>
<th>Secondary stabilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Shoulder Test</td>
<td>11.79 (10–12)</td>
<td>10.67 (8–12)</td>
<td>11.43 (8–12)</td>
</tr>
<tr>
<td>Satisfaction score after stabilization (&quot;3S&quot;)</td>
<td>12.43 (3–19)</td>
<td>–</td>
<td>17.29 (3–49)</td>
</tr>
<tr>
<td>Loss of external rotation</td>
<td>6.43 (0–35)</td>
<td>2.78 (–10–25)</td>
<td>11.43 (0–20)</td>
</tr>
</tbody>
</table>

The 3 groups did not differ in SST ($P>0.05$).

There was no significant difference in 3S score according to emergency or secondary stabilization ($P>0.05$). Hundred percent of emergency stabilization patients (14/14) and 83% of secondary stabilization patients (5/6) responded positively to the 3S question “With hindsight, would you undergo the operation again?”.

The 3 groups did not differ in loss of external rotation ($P>0.05$).

**Fig. 8.** Return to sport according to group.

**Fig. 9.** Comparative bilateral proprioception according to range of motion in emergency stabilized patients.

The mean difference in SHART between operated and contralateral shoulders in the emergency stabilization group was 3.45° (range, –5°–14°).

4. Discussion

The present study had several limitations:

- although the 2 groups were comparable, one was followed up continuously and prospectively, whereas the other was followed up retrospectively at one point in time;
- the sports practiced did not exclusively involve throwing or overhead movement, which are at the highest risk for recurrent dislocation;
- numbers in either group were small;
- there was no randomization.

The follow-up of 2 years might be considered too short to warrant any conclusion; the literature, however, agrees that, while
recurrence may occur after 2 years, it is mostly earlier (69% before 2 years, according to Hovelius [26]).

The originality of the study is that it is the only one to seek to combine the strong points of other studies:

- prospective and comparative;
- exclusively young athletic patients;
- short time to surgery;
- repair adhering to the current gold standard: arthroscopic suture on screwed metal anchors;
- global assessment: failure, functional scores, return to play, satisfaction, radiologic assessment;
- assessment of failure of stabilization (recurrence, subluxation, UPS) rather than of recurrence alone.

Emergency arthroscopic stabilization reduces the recurrence rate in young athletes. Other studies have assessed results after primary instability, sometimes with comparison with non-operative management [27–34]. Implants and techniques have improved over the years, reducing recurrence by 10% to 20% (staples: Wheeler et al., 22%; transglenoid suture: Arciero et al., 14% [35]; resorbable anchors: Bottoni et al., 11% [29]; screwed metal anchors: Shih et al., 5% [34]). The present recurrence rate was lower than previously reported: we consider that a standardized, reproducible surgical technique with evacuation of hemarthrosis [27] combined with lesion freshness provides an environment favorable to labral healing. Recurrence rates reported with non-operative treatment vary from 13% to 96% [1–6]. Hovelius reported a high recurrence rate for non-operative treatment in young athletes (88% in hockey players aged under 20 years) [36], while other series reported rates as low as 13% [1]. The present non-operative group did not show such good results, despite strict immobilization and well-conducted rehabilitation: 71% recurrence and 6% UPS, for 77% overall failure. We have no explanation for such discrepancy, unless it is the actual definition of failure. We considered it essential to count subluxation and UPS as failure. Not all authors do so, which may account for the differences in reported results. Some account for the variable success of non-operative management by invoking poor patient compliance: failure to respect immobilization times, non-specific rehabilitation [2,37]. Others consider traditional immobilization in internal rotation insufficient to ensure well-positioned labral and ligamentous healing as a safeguard against recurrence; they recommend immobilization in external rotation, to improve labral and capsular coaptation [38]. Ito et al. reported a 46% fall in the relative risk of recurrence in patients under 30 years of age [39]. However, two more recent series contradicted these findings, reporting no benefit in terms of recurrence with immobilization in external rotation [40–42]. Whatever the case may be, Hovelius et al. demonstrated that immobilization time does not affect recurrence [9], and a more recent meta-analysis came to the same conclusion, adding that the type of immobilization could not be incriminated either [43].

Thus, surgery provides benefit in terms of recurrence; but does that ensure good outcome? What is a good outcome?

Revision rates alone were long taken into account, without considering quality of life or return to play. What is the situation today?

Although no statistical comparison could be performed between groups according to functional scores (QuickDASH, Walch–Duplay, Rowe) due to lack of power, the scores were slightly better in the “emergency stabilization” group. This is in agreement with the literature and reinforces the idea of functional benefit with surgery [28–31,34,44,45]. It is difficult if not impossible to compare scoring across published series. There are several different assessment tools (Rowe, Walch–Duplay, WOSI, Insalata, SANE, ASES, DASH, SST, etc.) and each study chooses which to use. Indeed, this is one of the limitations of the two recent meta-analyses of the subject [46,47]. Satisfaction was comparable between emergency and secondary stabilization, despite the better functional scores of the former. The explanation for this lies in the definition of satisfaction, which concerns the difference between the functional results expected by the patient and that achieved. Patients stabilized in emergency systematically had an asymptomatic shoulder before the first dislocation and expect to recover it postoperatively. Patients stabilized secondarily for chronic instability, on the other hand, have less demanding functional expectations. Thus, even if functional results are somewhat poorer in the latter, satisfaction levels are comparable.

After primary dislocation, recurrence may result from less violent trauma; from dislocation to dislocation, the force implicated diminishes [48]. Thus, young subjects with unstable shoulder run an elevated daily risk of dislocation: while dressing, washing, or in their sleep.

Moreover, each new episode of instability leads to time off work and sport. Time off sport varies depending on the treatment option. An American series [14], in which patients were not immobilized and returned to sport once they were free of pain and had recovered range of motion, showed an mean time off sport of only 10 days (range, 0–30 days); two-thirds, however, required stabilization at the end of the season. Instability episodes are thus difficult to tolerate, frequently leading to a demand for stabilization. Moreover, even if return to play between episodes is feasible, the patient’s athletic level may be reduced [16]. In the present series, young athletes undergoing emergency surgery were able to return to play at their previous level, which was not always the case in secondary stabilization, not to mention non-operated patients. We consider that prolonged inactivity to achieve stabilization is more beneficial than early return to play, which induces recurrent instability and further joint damage.

Passing lesions appear with a first dislocation [49–51], as confirmed by the present CT and arthroscopic findings. There were always lesions in need of repair, but they were small and always accessible to arthroscopy (no labral damage; small bone lesions).

At each recurrence, passing lesions are exacerbated, with labral damage, capsule stretching and glenoid bone lesions and notching [52,53], reducing the chances of successful arthroscopic stabilization. Samelson and Prieto were the first to introduce the notion of shoulder osteoarthritis induced by instability [54]. At 25 years' follow-up, 50% of shoulders without recurrence showed radiologic signs of osteoarthritis, compared to 75% of shoulders with at least 1 recurrence; in stabilized patients, the osteoarthritis rate was 44% [55]. Labral damage, interval between primary dislocation and stabilization and number of dislocations before stabilization correlate with osteoarthritic evolution [56]. Stabilization thus avoids progressive deterioration of the joint.

Surgery as such is more expensive than non-operative therapy. Iterative non-operative treatment with repeated recurrence, however, multiplies costs and ends up being more expensive than surgery.

Crall et al. used a Markov stochastic model to estimate the total cost of non-operative management (probability of recurrence according to age, based on the literature) over 15 consecutive years in a male and a female patient aged 15 then 25 then 35 years, and estimated the corresponding total cost of surgery (recurrence and complications) over the same period. By 15 years after primary dislocation, surgery proved more effective and less costly than the non-operative option in a 15-year-old patient (male or female) and in a 25-year-old male; in a 25-year-old female and 35-year-olds of either gender, surgery was equally effective but more costly [57]. Invasiveness and possible iatrogenicity are arguments put forward by detractors of surgery; however, as in previous reports [27–31,33,34,58], the present series showed no major
complications. That surgical complications are not worsened by emergency stabilization is a telling argument in its favour. When informed of the rates of recurrence and complications associated with each treatment option, young active patients prefer surgery [59].

The specific advantage of arthroscopic Bankart repair lies in the anterior capsule–ligament retensioning, which needs to be enough to restore shoulder stability but not so great as to restrict range of motion, especially in external rotation. Here again, the present results agree with previous reports [29–31,34,58]. Emergency stabilization did not significantly restrict external rotation. Although the difference was not significant, mean loss of external rotation tended to be less after emergency than secondary stabilization (6.4° and 11.4°, respectively). Is capsule–ligament retensioning easier to judge in the acute phase, with only slight lesions? These results, however, are to be interpreted with caution, as not all patients with secondary stabilization were managed by arthroscopic Bankart repair: coracoid bone-block was used in some cases.

Arthroscopic stabilization did not affect shoulder proprioception, in agreement with the literature. Aydin et al. reported no difference in proprioception comparing the operated and contralateral limb or a healthy control population [60]. Preoperative assessment would have been interesting to enable comparison with long-term follow-up. Capsule–ligament lesions involve mechanoreceptor dysfunction [61]; proprioception is logically impaired before stabilization, but this difference with respect to the contralateral side fades over time, disappearing by 1 year’s follow-up [62].

Other than recurrence rates and functional results, there are no tools to assess capsule–ligament retensioning. Several authors have attempted to develop simple tools to diagnose inferior glenohumeral ligament tear. Gagey first described a passive abduction test: abduction exceeding 105° was taken as indicating inferior glenohumeral ligament tear, normal values being <95° [63]. However, upper limb abduction shows individual variation and should not be assessed only on the lesion side but rather with bilateral comparison. Coste et al. therefore logically performed a comparative study between unstable and operated shoulders, using Gagey’s test; they found 100% inferior capsule–ligament distension when differential passive abduction exceeded 30° [64]. Vuillemin et al. then developed a dynamic radiologic test (SHART) measuring the angle between the lateral edge of the scapular pillar and the humeral shaft in maximal passive abduction; more than 15° difference between shoulders was systematically associated with severe inferior capsule–ligament distension. We considered this simple test to be ideal for objective assessment of inferior glenohumeral ligament tension [65]. Our findings showed that no patients presented laxity at 2 years’ follow-up. Insufficient inferior glenohumeral ligament tension is a cause of failure in arthroscopic Bankart repair. The test allowed inferior glenohumeral ligament retensioning to be checked in all patients, although it could not be ascertained whether this was the sole factor of successful stabilization. Is stability possible with a positive SHART? [32,33,58].

5. Conclusion

The present study demonstrated that emergency arthroscopic stabilization after primary shoulder dislocation in young active patients provided good results in terms of recurrence and functional recovery. It also limited progressive joint degradation and health-care costs. Over the last decade, 4 meta-analyses [46,47,66,67] reported similar results in terms of recurrence, but were inconclusive regarding functional benefit. There is at present no management consensus. Should surgery await a first recurrence? That is systematically the present attitude, but we may be facing a change in strategy toward earlier surgery. Emergency stabilization of primary dislocation has a role; in the light of the present results, we will continue with this strategy, although longer follow-up will be needed to confirm these encouraging results. The choice of treatment is nevertheless up to the patient, after being informed of the risks and benefit of each option. Indications still need careful selection to optimise results with this procedure.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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