11 Arthroscopic Bankart Repair: How It Looks Today

Nuno Gomes, Mikel Aramberri, and Helder Fonte

11.1 Introduction

Shoulder instability is a common pathology and several treatment approaches are possible, from conservative to surgical. Still, several surgical techniques have been described to address this condition, each with different indications according to the pathological findings, patient's age, activity level and expectations [1].

Anterior instability of the shoulder results from different types of soft tissue alterations (Fig. 11.1), with or without bony defects. They may range from a classic Bankart lesion to other variants of capsulolabral lesions such as the Perthes lesion, a labral peel off to the glenoid neck also occurring with acute anterior instability, and the anterior labro-ligamentous periosteal sleeve avulsion (ALPSA) that has also been termed 'medialized Bankart lesion', which is more common in cases of recurrent than with first-time traumatic dislocations of the shoulder. The gleno labral articular disruption (GLAD) lesion is present when a superficial tear of the antero-inferior labrum is combined with a portion of articular cartilage of the contiguous quadrant of the glenoid and the humeral avulsion of glenohumeral ligaments (HAGL) lesion does not involve the labro-ligamentous complex at the glenoid, but represents an isolated tear of the IGHL at its humeral insertion following vigorous shoulder dislocation.

Besides the capsulolabral detachment from the glenoid leading to these well-described labral lesions, a plastic deformation of the capsule also occurs every time a shoulder dislocates, particularly at the first event. It is a phenomenon that is similar to what happens to a simple plastic bag that is stretched with the fingers. The deformation of the plastic after the first time it is stretched will never recover back to the previous condition.

It is this variability in the type and extent of the imaging and arthroscopic findings, along with the natural clinical history of each unstable shoulder, that makes it of utmost importance to precisely define the instability pattern in order to select the most appropriate treatment.

11.2 Background

Surgical treatment of the unstable shoulder has evolved significantly since the first descriptions of open techniques. With the increasing popularity of arthroscopy and improved techniques and implants, arthroscopic stabilization has

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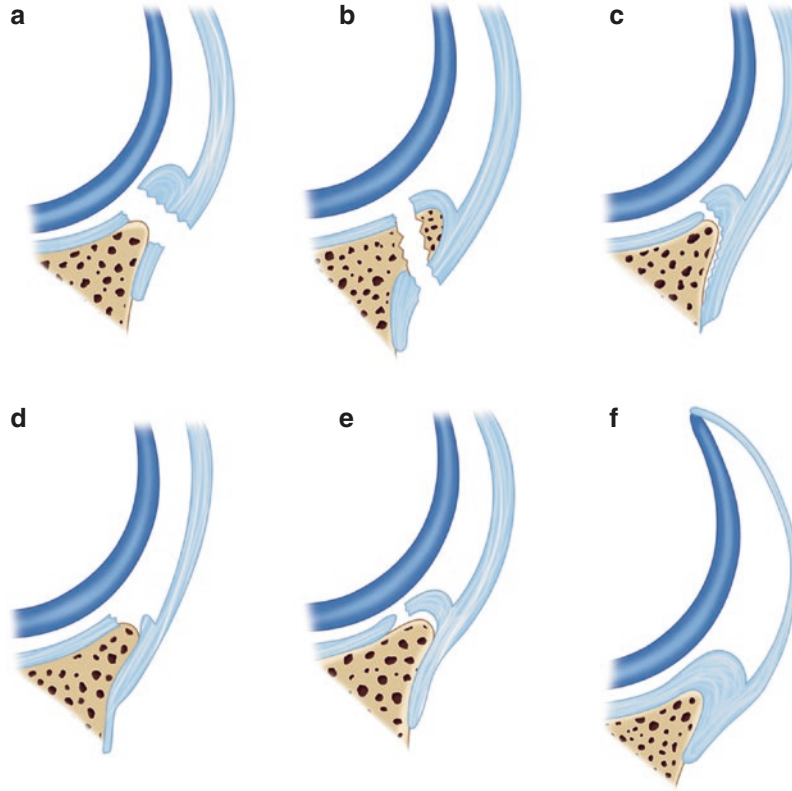

Fig. 11.1 Variants of labroligamentous lesions in the shoulder. (**a**) Bankart lesion; (**b**) Bony Bankart; (**c**) Perthes lesion; (**d**) ALPSA (Anterior Labro-ligamentous Periosteal Sleeve Avulsion); (**e**) GLAD (Gleno Labral Articular Disruption); (**f**) HAGL (Humeral Avulsion of Glenohumeral Ligaments)

very rapidly become an appealing and effective choice for the treatment of traumatic shoulder instability.

Early series on the results of arthroscopic repairs reported failure rates that were quite high, despite initial success rates [2, 3]. Later studies with longer follow-ups and updated surgical techniques comparing open and arthroscopic approaches reported variable results, from 3 to 18% after open techniques and 9 to 31% after arthroscopic techniques [4–8]. However, many others would state that there are no statistical differences between the two groups [9, 10]. One reason for such differences in results is the heterogeneity of the groups that were studied, considering that the indications for simple labral reconstruction are, for some, controversial. Furthermore, the techniques and implants used may have varied, offering today a higher potential for success.

11.3 Indications for Capsulolabral Repair

Whichever surgical technique is performed to address shoulder instability, the potential success of the arthroscopic or open procedures is similar as long as the surgeon is able to recognize and address all underlying relevant contributory pathologies. Many of the failures after isolated Bankart repair reported in the literature are probably due to improper patient selection and one must bear this fact in mind when interpreting scientific evidence.

Several pre-operative risk factors for failure after surgery have been recognized, namely, younger patient age, involvement in contact sports, important bony lesions in the glenoid and/or humeral head, hyperlaxity and concomitant rotator cuff or deltoid insufficiency. Still, even with correct recognition and consideration of these factors,

it seems that underestimated capsular tears and deformation are the most common cause of failure after arthroscopic Bankart repair [1, 11–13] along with inadequate correction of an excessively large anteroinferior capsular pouch and detached capsulolabral complex with poor quality tissue, more common after multiple episodes of dislocations or subluxations.

Bony lesion assessment is of utmost importance. The presence of a bony Bankart defect is very frequent in revision patients [13] and one should clearly distinguish between loss of glenoid contour such as the 'classic inverted pear glenoid' and an avulsion fracture of the anterior glenoid. While the latter may be treated arthroscopically by an anatomical reconstruction with no major increase in the failure rate [1], the former often has an associated attenuation of the anteroinferior capsulolabral complex that contribute to further erosion of the anteroinferior glenoid. In such cases, it is generally accepted that when a bony loss of over 20% is present, surgery should ideally include a bony reconstruction procedure [14–17].

Besides glenoid bony amputations, bone defects on the humeral head side, which are present in virtually all cases of shoulder dislocations, can also contribute to recurrent instability. The volume and the location of a Hill–Sachs lesion will interfere in the likelihood of repetitive dislocations, and several attempts to quantify it in the most effective way have been described.

The concept of an 'engaging' Hill–Sachs was introduced in order to qualify the humeral head lesion as one at a higher risk of recurrence if treated with a classic arthroscopic capsulolabral repair [18], which only addresses the restoration of the anteroinferior soft tissues. Such 'engagement' would have to be checked under anaesthesia or arthroscopically as the locking of the humeral head bone defect on the anterior glenoid rim in external rotation and abduction of the shoulder. In fact, as many would say, all dislocating shoulders are 'engaging' before performing the Bankart repair, voiding this concept of its major value and potentially leading to overtreatment of 'engaging' Hill–Sachs lesions. Yamamoto [19] therefore introduced the 'glenoid track' concept, which evaluates the zone of contact between the glenoid and the humeral head that is modified according to the arm position. The need for specific calculations under imaging, such as MRI or CT scan with 3D reconstruction, has certainly compromised wide acceptance of this method for routine usage despite allowing an objective identification of those patients with bipolar lesions at a higher risk of recurrence following isolated Bankart repair.

11.4 Techniques and Hardware

Surgical repair of a Bankart lesion follows steps that have been thoroughly described. The main discussion today is over the correct indications and whether there is place or not for associated procedures. However, enhancements in the technique and evolutions on implants and instrumentation have offered the orthopaedic surgeon a broader set of options to manage this lesion.

Current evidence would argue that there is hardly room for open repair of the labrum today. Still, variations in the arthroscopic approach may be necessary to be able to offer the most safe and effective method.

Both lateral decubitus and beach chair positioning allow for excellent visualization but the former may be advantageous for intra-articular procedures—which include instability repairs—due to the permanent double traction to the arm (Fig. 11.2), which will maintain the head retracted with a spacious joint.

A standard posterior viewing portal is established, which allows for a first intra-articular observation and diagnosis, followed by one or two additional anterior portals.

An anterior–inferior portal, ideally chosen using an outside-in technique with a needle, is located right superior to the subscapularis tendon through the rotator interval and slightly lateral to the glenoid plan, in a fashion that permits drilling and placement of an anchor at around 45° angulation in respect to the glenoid surface and as low as possible on the anteroinferior glenoid rim (Fig. 11.3).

Fig. 11.2 Patient in lateral decubitus with permanent double traction to the arm, offering good joint distraction for hassle-free intra-articular arthroscopic procedures. According to the case, traction between 2 and 3 kg may be used on each vector

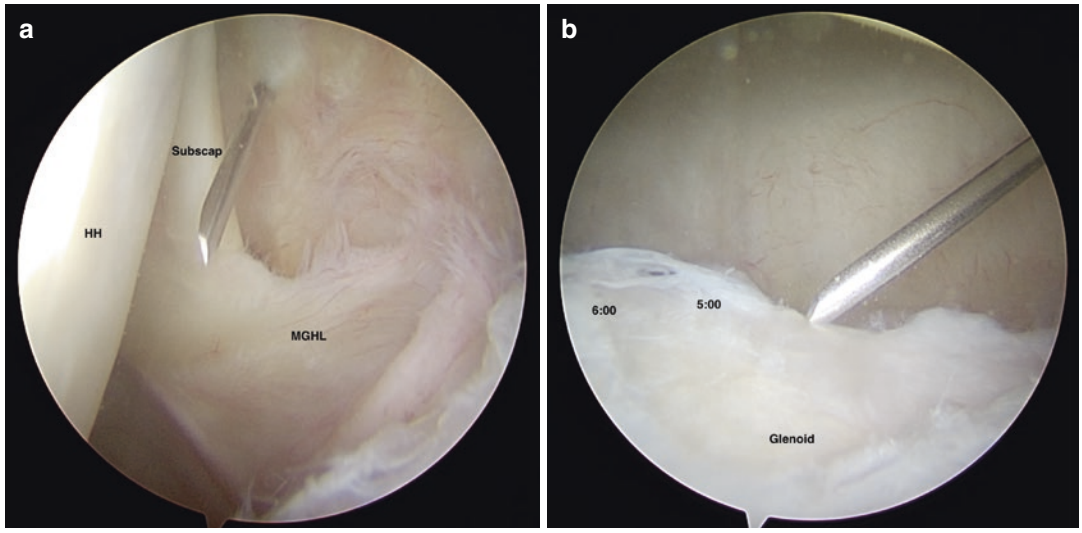

Fig. 11.3 Anterior-inferior rotator interval portal in a left shoulder; (**a**) located using an outside-in technique with a needle, right superior to the subscapularis tendon and slightly lateral to the glenoid plan, (**b**) allowing drilling and placement of the most inferior anchor at around 45° angulation in respect to the glenoid surface

A second anterior portal may be useful for both instrumentation and viewing (Fig. 11.4). It is placed at the superior border of the rotator interval, right behind the long biceps tendon, or directly through the pulley on top of the long biceps. Viewing from this portal may identify anterior labrum lesions more properly, allowing an easy mobilization and tensioning of the soft tissues, invaluable for a proper capsulolabral plication.

An alternative to this, in case a SLAP lesion repair is planned, is using a transcuff approach instead (Fig. 11.5), which can be used for both instrumentation and anchor placement in the superior labrum.

The use of a percutaneous 5:30 o'clock portal [20] through the subscapularis muscle is an option that can be very useful to place the lowest anterior anchor. It allows a safe drilling into the glenoid vault and avoids the risks of marginal drilling when using a rotator interval portal for that purpose.

It has been demonstrated that drilling for the most inferior anchor from a standard rotator interval portal will most likely perforate the far cortex on the inferior glenoid neck [21], with risks of iatrogenic lesion to the axillary nerve and of impairment of the anchor fixation. Following the placement of the anchor through this portal, subsequent handling of the sutures and soft tissue repairs are performed in a classical way using other portals.

To minimize this risk of missing the best drilling direction for the most inferior anchor, some companies offer the possibility of using a curved guide and a flexible drill, enabling an effective perforation of a tunnel inside bone, dispensing the 5:30 portal.

Fixation of the capsulolabral tissue to the glenoid rim can be effectively achieved by the usage of different types of anchors and suture configurations. Evolutions on these have been the rule since the advent of shoulder arthroscopy, with various reports contributing to a better knowledge of the biomechanical properties of the fixation today.

The recognition of the capsulolabral footprint led to the description of double-row fixations on the glenoid by Lafosse et al.—the Cassiopeia technique—and later by other surgeons [22–25], with significant improvement in functional outcomes with no major complications. However, in spite of laboratorial studies and a few low-strength studies with patients showing the time-zero strength of this technique, there is no clinical evidence that this option has advantages over the single row and the higher risks of complications and increased costs must not be underestimated.

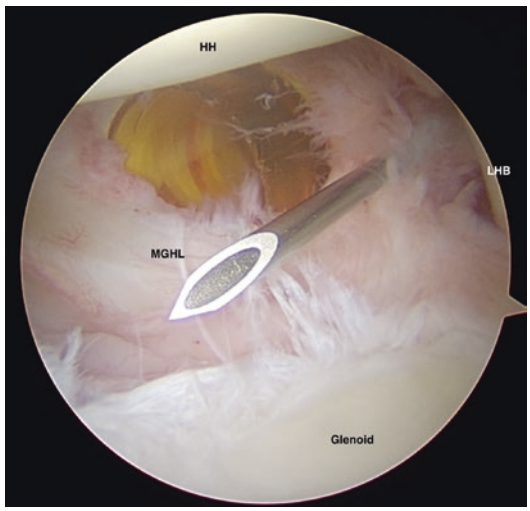

Fig. 11.4 A second anterior portal may be useful for both instrumentation and viewing at the superior border of the rotator interval, right behind the long biceps tendon, or directly through the pulley on top of the long biceps. Viewing from this portal may identify anterior labrum lesions more properly, allowing an easy mobilization and tensioning of the soft tissues, invaluable for a proper capsulolabral plication

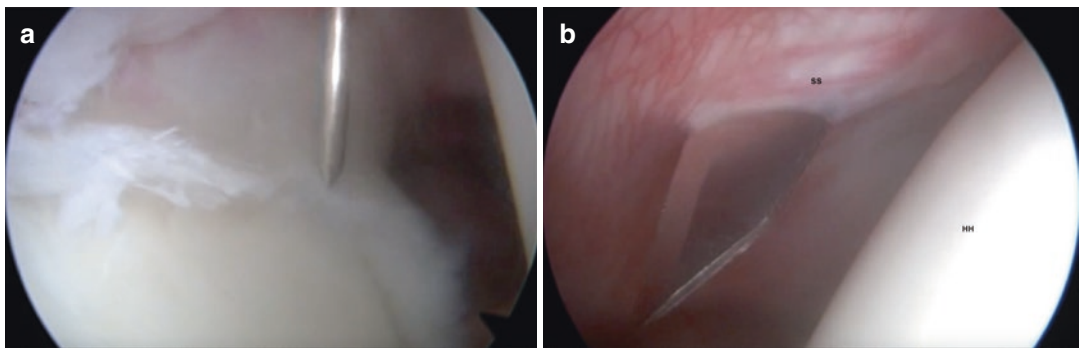

Fig. 11.5 Right shoulder. In the case of a SLAP lesion, a transcuff approach can be used for anchor placement in the superior labrum. The same portal can also be used for instrumentation for a 360° labral repair. (**a**) choosing the location; (**b**) one stab incision in line with the supraspinatus fibers

Other Bankart repair configurations are widely used and have deserved a dedicated comparison (Fig. 11.6). Classical knotted and knotless fixations, simple vertical stitch, horizontal mattress stitch, Mason–Allen (a combination of a mattress and single stitch with a double-loaded anchor) [11, 26], double-row and purse-string [27] techniques have all been presented as viable options but there is a lack of strong clinical evidence of advantages of one over another.

Double-row repair techniques have been shown to provide better coverage of the native footprint of the labrum but have not provided superior biomechanical properties in the lab compared to single-row repair techniques. There is no clear difference in footprint coverage, gapping, stiffness or biomechanical strength between the simple suture and horizontal mattress suture repair techniques [28]. Likewise, the same authors did not find any additional strength by using labral tape in double-row fixations.

Mattress type repairs are reportedly more effective in achieving a more anatomical reconstruction of the labral stump, potentially more similar to the native labral slope with a bumper effect, but they have been shown to offer identical biomechanical characteristics when compared to simple suture repairs [29]. In fact, laboratorial and post-operative studies with MRI have shown that the labral slope, height and morphology are reliably restored at 15 months after using bioabsorbable knotless anchors, similar to controls and other reports on simple knotted repairs [30]. There is also no difference in the radiological and clinical outcomes at, respectively, 6 months and at least 2 years after surgery between using a simple stitch and a modified Mason-Allen stitch in arthroscopic Bankart repairs [26].

The availability of different types of anchors in the market for this purpose today is very wide and they definitely deserve an overview, considering their role in the final clinical result. Major evolutions have taken place concerning this matter since the advent of shoulder arthroscopy in order to increase its success and limit the risk of complications.

Despite the good results of the first reports on arthroscopic Bankart repairs, the rate, pattern and extent of the complications due to the usage of metallic suture anchors in the glenoid

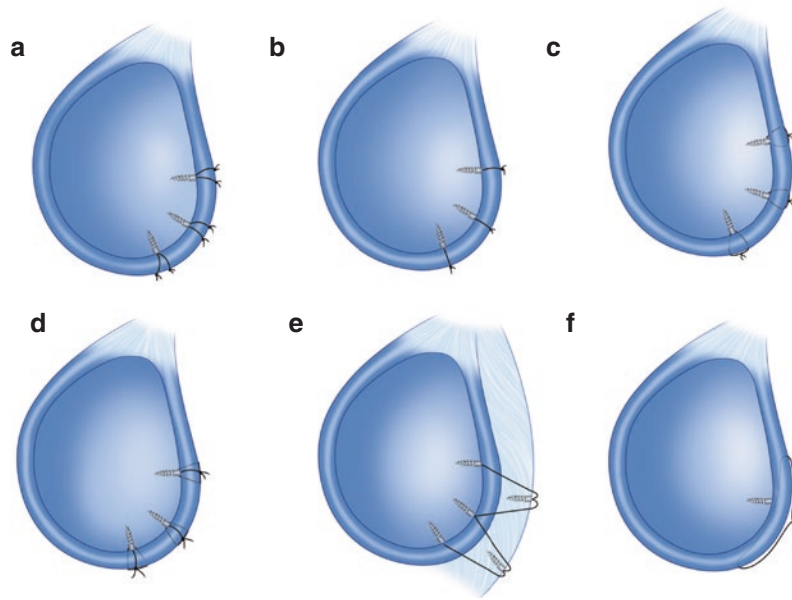

Fig. 11.6 Bankart repair configurations: (**a**) vertical stitch with double-loaded anchor, (**b**) simple vertical stitch with single-loaded anchor (knotted or knotless), (**c**) horizontal mattress stitch, (**d**) Mason–Allen, a combination of a mattress and single stitch with a double-loaded anchor [11, 26], (**e**) double-row and (**f**) purse-string [27] techniques

lead to a shift from metallic to bioabsorbable implants [31–33]. The acceptance of 'arguably' biodegradable suture anchors, such as the slowly degrading pure PLLA (poly-L-lactic acid) or more rapidly degrading biocomposite PLLA/β-tricalcium phosphate-based anchors was, for that reason, very high among orthopaedic surgeons. Nevertheless, even these are not risk-free, with reports on breakage, osteolysis, chondrolysis and synovitis after using them [34] and therefore the constant evolution in implant types and profiles, with older anchors and techniques being replaced with newer ones as technology develops. Besides biodegradable lactide-containing suture anchors, other innovations included the use of polyetheretherketone (PEEK) as the anchor material, the addition of multiple high-strength sutures made in part or entirely with ultrahigh molecular weight polyethylene (UHMWPE) and the development of 'knotless' designs.

PEEK is a radiolucent but not biodegradable plastic suitable for a variety of implants that has the advantages of being high strength, enabling good post-operative imaging and facilitating revision surgery because it is soft enough to be drilled through [35]. However, complications due to the fact that it is a rigid implant are not negligible and therefore the appeal for newer options, such as the all-suture anchors.

All-suture anchors are made using UHMWPE—the material of which virtually all the anchors' sutures currently in the market are made of—and perform very well in terms of pull-out strength in the lab, in some cases better than their rigid counterparts [35, 36]. However, some biomechanical concerns have been reported with the use of these newer anchors, namely, the first-generation ones [37], concerning load to failure and bone cyst formation [38]. A direct comparison between an all-soft and a rigid biocomposite glenoid anchor revealed a histologic and biomechanical response in dogs [38] that brought some concern about the former, by means of a large cyst-like cavity formation with a rim of dense lamellar bone in the anchor sites. This potential risk for clinical failure has motivated further studies and another group found satisfying radiological and clinical outcomes after arthroscopic instability surgery using first-generation all-suture anchors in human patients [39]. Unlike the canine models of the previous report, these patients followed a classical post-op protocol that included immobilization, and imaging at early follow-up (12–28 months) revealed good labral healing without important bony reaction or the formation of large cysts.

In spite of some differences in displacement after cyclic loading between different all-soft anchors for the glenoid [40], it has been demonstrated that this phenomenon can be minimized by slightly reducing the insertion depth for the anchor [41] which will minimize the amount of bone stock that is destroyed with a deep drilling. At the end of the day, its overall efficacy compares favourably to standard solid anchors for labral repairs.

Knotless anchors for labral repair have been an appealing option for some time now and have been subject to several comparisons in the literature. They offer the advantage of a quicker and easier repair, diminishing the potential for errors, and absence of a bulky knot stack that may lead to early osteoarthritis when present and rubbing against the chondral surface. Furthermore, the rate of glove and skin lacerations is lower, recognized as a risk for both the patient and the surgeon when tying knots. [42]

While some studies report no significant differences between the two options [43, 44], others report worse clinical results using knotless anchors when compared to classical knot-tying suture anchors [45].

But one must be judicious when interpreting these scientific conclusions. Generally speaking, there are two different kinds of knotless labral anchors available, demanding either an 'anchor first' or 'suture first' technique for their usage. All the comparisons available in the literature consider the 'suture first' technique anchors, which, as recurrently reported, do not allow the best estimation of the tension to give the sutures and respective soft tissues fixation.

However, an 'anchor first' technique, due to its different method of application and tissue fixation, does not present with the same issue

and may be a valuable option without such limitation (Fig. 11.7).

Regardless of the type of anchor that is used, a satisfactory capsular shift is mandatory whenever there is a need to reduce the capsular volume, which is normally the case. Previous reports have demonstrated that a minimum of three double-loaded suture anchors had to be used for that purpose [1] but another one states that one or two anchors could be enough, as long as the capsulolabral tissue is plicated as desired [27].

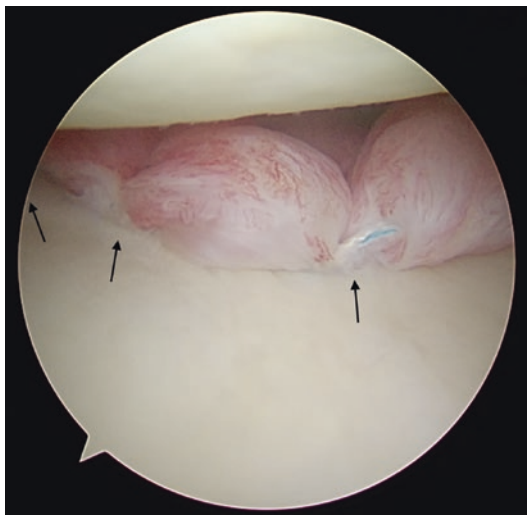

Fig. 11.7 Capsulolabral repair in a left shoulder using a knotless 'anchor first' technique, showing two out of three all-soft anchors with no proud knot stack

It seems today that all-soft anchors, being less invasive and requiring a significantly smaller bone tunnel than rigid suture anchors, may reduce the risk of hardware complications such as secondary joint damage or glenoid fracture, and at the same time allow a safer drilling for multiple anchors into a small anatomic area, in case of failure of a previous one or in the revision setting. Besides, in the event of marginal tunnel drilling or perforation of the far cortex, the fact that these anchors only require an intact cortical surface for proper seating will likely diminish the risk of their loosening (Fig. 11.8).

These facts may eventually lead to better clinical results in the long run and widen the indications for soft tissue repairs, compared to bony procedures.

Still, objective criteria are necessary in order to take a better-informed decision on the treatment of an unstable shoulder.

11.5 Discussion and Conclusion

Given the subjectivity and lack of consensus on the surgical management of shoulder instability, Balg and Boileau [46] proposed a simple ten-

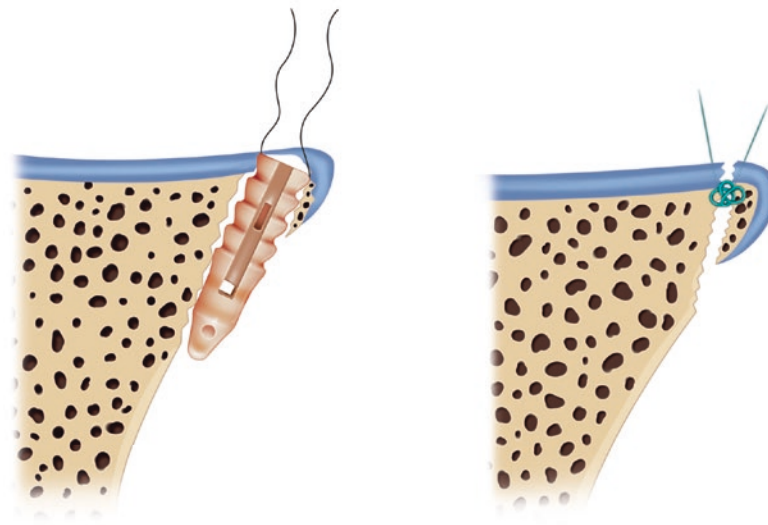

Fig. 11.8 The thin tunnel for all-soft anchors allows multiple anchors into a small anatomic area, in case of failure of a previous one or in the revision setting. In the event of marginal tunnel drilling or perforation of the far cortex, the sole requirement for an intact cortical surface for proper seating, usage of a soft anchor will likely diminish the risk of their loosening

point scale Instability Severity Index Score (ISIS) to determine the risk of recurrence following isolated arthroscopic Bankart repair. It considers several prognostic factors, which, if present, add up 1 or 2 points to the final score: age below 20, being into competitive, contact or overhead sports, hyperlaxity and important bony losses either on the humeral head (Hill–Sachs lesion) or the glenoid. A score of 3 or less was associated with a 5% recurrence rate and a score above 4 was associated with an unacceptable recurrence rate after an isolated Bankart repair and therefore a bony reconstruction should be performed. In spite of some recognized weaknesses [47, 48], the ISIS is a useful tool for the surgeon to choose the optimal surgical treatment and minimize the risk of recurrent instability.

Still, many questions remain unanswered concerning this matter, despite substantial progress made in the understanding of risk factors for recurrence following surgical treatment of anterior shoulder instability.

Arthroscopic remplissage for anterior instability has become an adjunct to Bankart repairs since it was first described in 2008 as a means to augment the labral repair in patients with subcritical glenoid bone loss.

However, the critical level of glenoid bone loss requiring bone grafting or coracoid transfer is not clearly defined, ranging from 10 to 25% according to different researchers [49]. This led to the definition of the glenoid track concept as a means for defining the need for isolated Bankart with or without remplissage versus Latarjet [50] as described in another chapter of this book. It is a valid tool to guide the surgeon but, like other tools available for the same purpose, has limitations, since it is often difficult, inaccurate and not very practical to calculate and does not account for soft tissue quality and patient factors such as age and sex.

Taking this into account as well as evidence that the soft tissues repair is of undeniable importance, even when performing a Latarjet [51], it is clear that a proper capsulolabral reconstruction has a major place in shoulder instability treatment today.

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