Latarjet-Bristow Procedure Performed With Bioabsorbable Screws

Computed Tomography Evidence of Healing

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Abstract: The Latarjet-Bristow procedure has been shown to be a safe and reliable method of treating recurrent anterior instability. We proposed using bioabsorbable screws for fixation of the coracoid graft to avoid the potential complications associated with metallic hardware. The aim of this study was to assess the early radiologic healing of the graft using bioabsorbable screws and comment on our initial experience using this method of fixation for the Latarjet-Bristow procedure. Twelve Latarjet-Bristow procedures were performed for recurrent anterior instability using two 4.5-mm bioabsorbable compression screws composed of L-lactic/co-glycolic acid copolymer (PLGA 85L/15G). All patients had follow-up imaging including plain radiographs and a computed tomography scan performed at 3 months postoperatively to assess bone healing and graft position. In all cases, there was radiologic evidence of bony graft healing in a satisfactory position. There were no intraoperative or postoperative complications observed. This study confirms that satisfactory bone healing in the Latarjet-Bristow procedure can be obtained with the use of bioabsorbable screws. Although the early radiographic results were encouraging, at this stage, we cannot recommend the use of bioabsorbable screws for use with the Latarjet-Bristow procedure until the long-term clinical and radiologic outcomes are assessed.

Level of Evidence: Case series (IV).

Key Words: Latarjet-Bristow, Latarjet, bioabsorbable, PLGA, anterior instability, bone healing, nonunion

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The Latarjet-Bristow procedure has proven to be a reliable and safe procedure for the management of recurrent anterior instability, particularly in cases with significant bone loss.[1–4] Traditionally, the coracoid graft has been fixed to the glenoid with either 1 or 2 metallic screws. Although there is only a low complication rate associated with the Latarjet-Bristow procedure, one of the reported reasons for revision surgery relates to screw removal.[5–7] The incidence of screw removal is small but appreciable, about 2% to 3% in our experience of over 2000 cases, and is usually performed for pain related to irritation from the head of the screw. Another concern regarding the use of metallic screws is the possibility of interference artefact with follow-up imaging studies. To avoid these potential problems associated with metallic hardware, we considered using bioabsorbable screws for fixation of the coracoid graft. Our primary concern was the ability of the coracoid graft to heal satisfactorily with the use of bioabsorbable screws. The screws must provide sufficient compression to encourage bony union and maintain their strength to allow active shoulder rehabilitation at least until the graft has healed sufficiently, typically at 3 months post-operatively. We were also interested to know whether there were any specific intraoperative complications relating to the use of bioabsorbable screws, such as screw breakage during insertion. The aim of our study was therefore to assess the early radiologic healing of the graft using bioabsorbable screws and comment on our initial experience using this method of fixation for the Latarjet-Bristow procedure.

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The Institutional Review Board of the ethical committee of the Hopital Privé Jean Mermoz and the Centre Orthopédique Santy approved this study (Ref. Study 11).

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MATERIALS AND METHODS

The open Latarjet procedure is the senior authors' primary procedure for recurrent anterior instability. In 2009, 12 open Latarjet-Bristow procedures were performed using bioabsorbable screws in 11 patients with recurrent anterior instability. Seven of the patients were male and 4 female. Ten of the 11 patients were right-hand dominant and 6 of the procedures were performed on the dominant shoulder. The mean age at the time of surgery was 28.6 years (16.6 to 46.3 y). All patients had a preoperative positive apprehension test and positive relocation test.[8,9] One patient was noted to have a full-thickness supraspinatus tear that was repaired with transosseous sutures at the same time as the Latarjet-Bristow procedure.

Institutional Review Board approval was obtained for performing this study.

Bioabsorbable Screws

The screws used in this study were 4.5 mm bioabsorbable compression screws [Resorbable Fixation System (RFS), Tornier, TX] composed of L-lactic/co-glycolic acid copolymer (PLGA 85L/15G) (Fig. 1). The screws were inserted according to the manufacturers' instructions and according to the same instructions are reported to maintain their strength for the initial 8 weeks with absorption taking place approximately within 2 years. These polymers degrade in-vivo by hydrolysis into α-hydroxy acids that are metabolized by the body. The screws are designed to be compatible with Arbeitsgemeinschaft für Osteosynthesefragen instrumentation and include a disposable metallic insertion adapter.

Surgical Technique

The procedure was performed as described earlier,[2] derived from the Latarjet technique[3] and modified by Patte and

FIGURE 1. A 4.5 mm Resorbable Fixation System (RFS) bioabsorbable compression screw (Tornier, TX) including the disposable metallic insertion adapter.

Debeyre.[10] Under general anesthesia and with an interscalene block, the patient was placed in the beach-chair position. A vertical skin incision was made from the tip of the coracoid process extending 4 to 5 cm toward the axillary fold. A limited deltopectoral approach was used. The coraco-acromial ligament was divided 1 cm from its insertion on the coracoid process and the pectoralis minor released at its insertion on the coracoid process. The coracoid process was then osteotomized at the junction between horizontal and vertical parts. The cortex of the inferior aspect was removed with an oscillating saw to create a flat cancellous bone surface. Two holes were drilled with a 3.2 mm drill bit approximately 1-cm apart (1 superior and 1 inferior). The holes were then prepared with a 4.5 mm tap and a countersink (Fig. 2A). The subscapularis muscle was divided in line with its fibers at the junction of the superior two-thirds and inferior one-third to expose the anterior capsule. A vertical arthrotomy was performed and an intra-articular retractor placed. The Bankart lesion including the labrum and anterior periosteal sleeve was excised. The antero-inferior cortex of the glenoid was removed with an osteotome to provide a flat cancellous bed. The inferior hole was drilled into the glenoid and tapped with the 4.5 mm tap (Fig. 2B). The coracoid graft was then fixed with the first screw so that it lied flush with the glenoid articular surface. A 4.5-mm bioabsorbable screw (RFS Screw, Tornier, TX), typically 35 mm in length, was inserted using a 2-finger tightening technique to avoid overtightening. Definitive fixation was achieved by drilling the superior hole through the coracoid and the glenoid, tapping, determining screw length with a depth gauge, and inserting a second 4.5-mm bioabsorbable screw of appropriate length. The initial screw was further tightened with a 2-finger technique to ensure adequate compression of the graft. The position of the graft was checked to ensure that it was lying flush with the glenoid articular surface and importantly that there was no lateral overhanging. Lastly, the coraco-acromial ligament stump was sutured to the anterior capsule with the arm positioned in maximal external rotation.

Postoperative Rehabilitation

The patients were instructed to wear a simple sling for 15 days. Rehabilitation with self-mobilization in elevation and external rotation was allowed from day 3. At 15 days

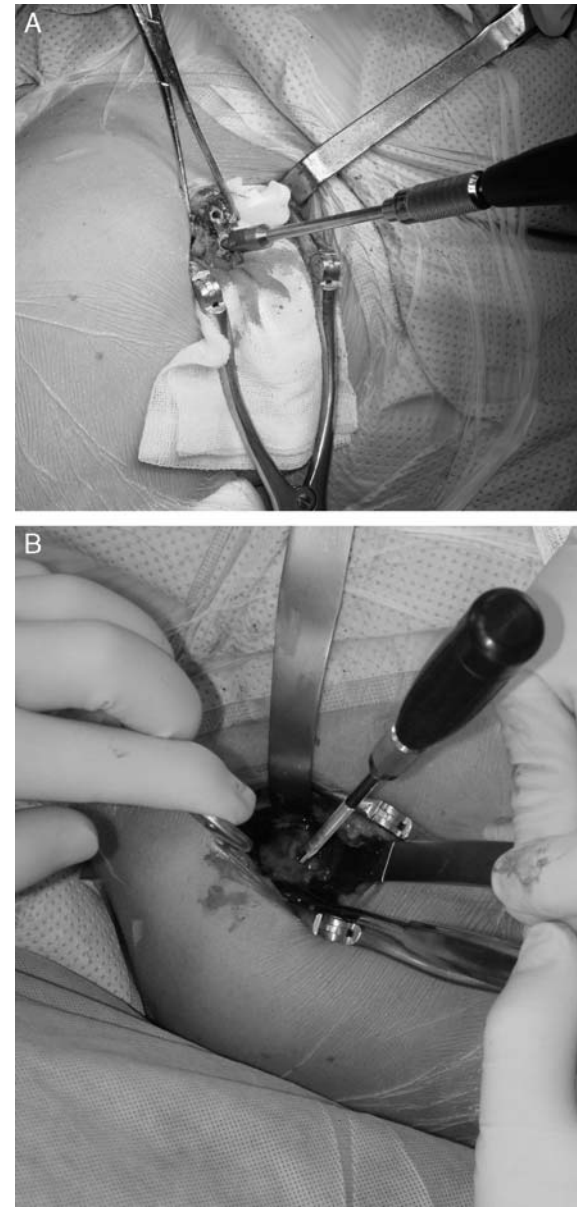

FIGURE 2. A, Preparation of the coracoid graft with a countersink. B, Preparation of glenoid drillhole with a 4.5 mm tap.

postoperatively, usual activities of daily living were allowed and self-mobilization in elevation and external rotation was continued. At 1 month postoperatively, patients were allowed to progressively resume athletic conditioning (eg, jogging, cycling, and swimming) without any strengthening exercises for the upper limbs. Progressive return to sporting activities, including contact sports, was allowed at 3 months after clinical and radiographic evaluation showed satisfactory healing of the coracoid graft.

Radiographic Assessment

All patients had a complete preoperative radiographic evaluation performed under fluoroscopic control including anteroposterior views in neutral, external, and internal rotation and a comparative axillary view according to Bernageau et al.[11]

All patients had plain radiography performed on the first postoperative day and again at 3 months. In addition, CT scans were obtained for all patients at 3 months postoperatively. Healing of the bone block on the anterior glenoid was assessed on both plain radiography and CT scans at follow-up. Radiologic evidence of healing was confirmed by bridging with bone between the bone block and the glenoid, in addition to the absence of radiolucency at the site of healing. The presence of a complete radiolucent line between the graft and the glenoid was considered to represent a nonunion or pseudarthrosis of the bone block.

The position of the bone block was also evaluated in the horizontal plane with the CT scan. Three positions were defined: flush when the bone block and the glenoid were in line or positioned within 2 mm medial, overhanging when the bone block was lateral relative to the glenoid joint line, and medial when the bone block was medial relative to the joint line by more than 2 mm.

RESULTS

All patients were observed to have radiologic evidence of bony graft healing on both plain radiography and CT (Fig. 3). The positions of all bone grafts were deemed to be satisfactory, that is, lying flush with the glenoid. There were no cases showing early osteolysis or drill hole widening.

There were no intraoperative complications observed in this series. Specifically, we did not observe any screw breakage at the time of insertion. In addition, there were no early postoperative complications such as hemotoma, infection, synovitis, graft fracture, graft displacement, or nonunion. All patients had a stable shoulder at 3 months follow-up.

DISCUSSION

The use of bioabsorbable implants has become increasingly popular in orthopedic surgery and they have been used for internal fixation since the early 1990s.[12–14] The potential advantages of using bioabsorbable materials include the avoidance of metallic implant-related complications, no need for subsequent screw removal, and limiting interference with follow-up imaging studies such as magnetic resonance imaging. Consequently, in shoulder surgery, the use of bioabsorbable suture anchors for soft tissue fixation has largely replaced metallic suture anchors.[15,16] Despite the documented safety and satisfactory performance of bioabsorbable implants in shoulder surgery,[15,17] there have been numerous reports highlighting potential complications. Complications related to bioabsorbable implants used for arthroscopic shoulder surgery have included osteolysis, synovitis, accelerated arthropathy, and loss of fixation.[15,18–21] Initial reports of foreign body reaction and osteolysis were thought to be associated with the rapid breakdown of first generation polyglycolic acid implants, however, there have also been reports of osteolysis associated with slower degrading polylactic acid (PLA) designs.[20,22] Moreover, clinical studies of bioabsorbable implants made from PLA have shown longer than expected degradation times and failure of the resorbed implant to be replaced with bone.[23] A recent study investigating the use of PLA anchors for arthroscopic capsulolabral repair found that 40% of anchors showed osteolytic enlargement of the drillholes at 12 months postoperatively.[24] The RFS Screw used in our study is composed of an PLGA 85L/15G and is reported by the manufacturer to be resorbed within approximately 2 years. We are unaware of any clinical data to confirm the time of resorption, or indeed whether the screws

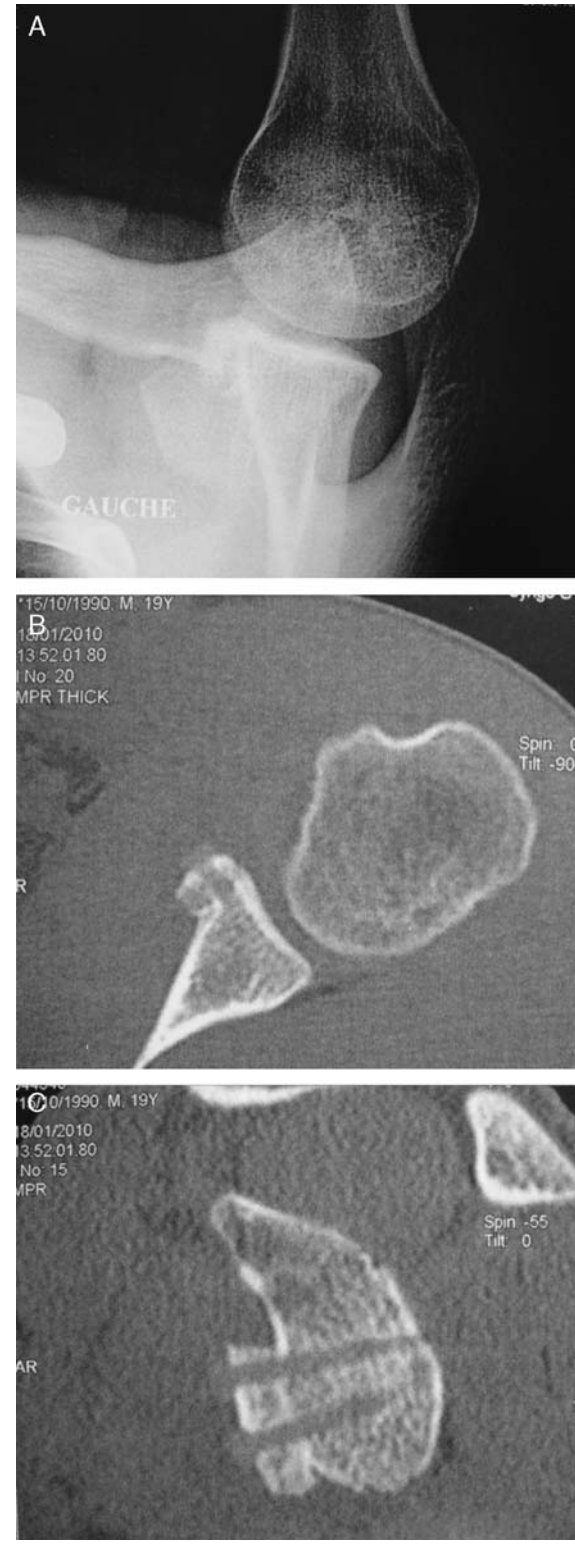

FIGURE 3. Plain radiographic Bernageau view (A); and computed tomography scan images [Axial (B) and sagittal (C) planes] showing bony healing of the coracoid graft in a satisfactory position.

are eventually replaced by bone and whether there is any evidence of osteolysis. The use of PLGA in maxillofacial osteosynthesis has been reported to show reliable biocompatibility and disintegration of implants within 12 months.[25] Although reossification of burr holes was observed in that study another 12 months later, there were 35% of holes that showed a temporary increase in diameter. The occurrence of osteolysis or drillhole enlargement would be concerning for us given the potential for weakening of the coracoid graft and risking secondary fracture. Although we did not observe any obvious osteolysis or screw hole enlargement in this study, the follow-up period of 3 months was not appropriate to properly assess and definitively comment on this. Long-term clinical and radiologic follow-up is required to confirm the safety of this implant for use in the Latarjet-Bristow procedure.

We have previously had an unsatisfactory experience in attempting fixation of the coracoid bone block with bioabsorbable screws. In the mid 1990s, using a different implant to that used in this study, we observed 8 of the 23 patients (35%) with nonunion or graft fracture/displacement at 3 months postoperatively (unpublished data). Screw breakage at the time of insertion was also noted to be a common problem. We are aware of only one other study that has reported on the use of bioabsorbable fixation of the coracoid graft in the Latarjet-Bristow procedure.[26] Using a biodegradable PLA expansion plug, they reported 4 of 33 cases with fixation failure or loosening related to the implant that required revision surgery and a nonunion rate of 16.7% in those patients who had follow-up with a CT scan. Although the patient numbers were less in our study, the results we have reported for graft fixation and bony healing compare favorably. It is important to note, however, that our results are specific for the type of bioabsorbable screw used in this study and cannot be assumed to be the same for other types of bioabsorbable screws or devices.

The reported rate of nonunion observed with variations of the Latarjet-Bristow procedure using conventional metallic screws ranges from 0% to 28%.[1,5,6,27–30] The use of 2 screws instead of 1 screw to secure the coracoid graft reduces the risk of nonunion and in our experience the rate has been around 2.5%.[2] Although it was encouraging to observe a 100% rate of healing in our study with bioabsorbable screws, the small number of patients precludes us making definitive statements regarding the bony healing or comparisons with metallic screws. We recommend careful preparation of the coracoid and glenoid to expose flat cancellous surfaces for bony healing and tightening the compression screws with a 2-finger technique. Biomechanical testing has shown that bioabsorbable screws can achieve interfragmentary compression similar to that of traditional metal screws.[31,32] In a recent study, the use of bioabsorbable screws to secure the bone block in a tibial inlay technique for posterior cruciate ligament reconstruction has been shown not to compromise the strength characteristics afforded by metallic fixation.[33] An earlier study compared the compression generated by bioabsorbable screws and similarly sized metal screws in a cortical bone substrate and found that although the amount of compression generated was similar in the first week, thereafter the residual compression was significantly less in the absorbable screw construct.[34] In the case of cancellous bone, there was a more rapid loss of compression over a 2 to 4-day period similarly in both absorbable and metallic screws. The bioabsorbable screws used in this study are reported by the manufacturer to be designed with an inherent dynamic compression mechanism (Auto-Compression). The implant is designed to change its dimensional characteristics in hydrolytic conditions. These results in the increasing diameter and the decreasing length by approximately 1% to 2% of the original dimensions, thereby providing sustained compression during bone healing. We were unable to test this ability of the screw in our study and are therefore unable to comment further than the manufacturers' instructions.

Our study has a number of limitations. Firstly, it is a relatively small case series with short-term radiologic follow-up and no control group. Further studies are needed to assess the clinical outcome of this new technique and make comparisons with the results of traditional fixation using metallic screws. Our belief was that satisfactory graft healing at 3 months would be associated with a clinical outcome similar to our earlier experience with the Latarjet-Bristow procedure, but obviate the need for potential subsequent screw removal. This needs to be proven to be the case with long-term follow-up. Given our earlier poor results with the use of bioabsorbable fixation in the Latarjet-Bristow procedure and concerns regarding the possibility of osteolysis related to the use of bioabsorbable screws, we limited the initial number of patients in whom we performed this new technique until we can provide long-term follow-up of the results.

This study confirms that satisfactory bone healing in the Latarjet-Bristow procedure can be obtained with the use of bioabsorbable screws. We will continue to observe this group of patients and report on both the clinical and the radiologic outcome, including whether there is any evidence of osteolysis and whether there is replacement of the bioabsorbable screw with bone. At this stage, we cannot recommend the widespread use of bioabsorbable screws for use with the Latarjet-Bristow procedure.

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