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ORIGINAL ARTICLE

The chondral print sign: what does it really mean?

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Background: The chondral print (CP) sign is a chondral change on the humeral head underneath the long head of the biceps (LHB) tendon. Several suggested causative links have been described, but the pathologic mechanism remains unclear.
Methods: We designed this prospective cohort association study of 102 consecutive shoulder arthroscopies to investigate proposed associations of CP with LHB, rotator cuff, labral pathology, and other chondral lesions. Data collection was by a specifically designed pro forma, and statistical analysis was performed.
Results: We identified 24 patients (23.5%) with the CP sign. Patients were a mean age of 58 years. Shoulders with positive CP sign had associated pathologies: 16 superior labral anteroposterior (SLAP) tears, 4 LHB instabilities, and 11 other LHB lesions. We also recorded other chondral lesions, 10 humeral head and 12 on the glenoid surface. The overall arthroscopic appearance of CP signs could be classified into 3 different types. Statistical analysis revealed that the CP sign is not statistically associated with LHB instability, any other LHB pathologies, rotator cuff tears, or instability. The CP sign was statistically positively associated with SLAP lesions (but only if type 1 were included). There was a weak association of CP sign with age and a positive association of SLAP lesions with other (non-CP) humeral chondral lesions.
Conclusions: Our prospective association study cannot determine the cause of the CP sign. It does not seem to be a reliable sign of LHB instability or of other LHB pathology. There is an association with age and degenerative SLAP lesions.
Level of evidence: Level III; Cross Sectional Design; Epidemiology Study

Keywords: Chondral print sign; associations; long head of biceps; biceps instability; biceps pulley lesion; SLAP tear

Pathology of the long head of the biceps tendon (LHB) is a common cause of pain and dysfunction of the shoulder but is still difficult to diagnosis and treat by clinicians. Problems of the LHB can present in the form of an LHB origin instability resulting from a superior labral anteroposterior (SLAP) lesion or from a lesion of the biceps reflection pulley. LHB lesions requiring treatment include SLAP lesion, tendinitis, partial-thickness tears, and instability such as dislocation or subluxation.[12] The diagnostic difficulties of LHB instability are also due to the common association with other shoulder pathologies.[3] The development of arthroscopy has contributed to improved understanding and treatment of this pathology, but chronic subluxation of LHB can be still missed easily.

The chondral print (CP) sign is a chondral change on the anterosuperior humeral head, underneath the LHB tendon. This was first mentioned by Sistermann[10] using the analogy with the "footprint" of the rotator cuff (Ruotolo et al[9]), as the "biceps

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tendon footprint." It was a pathologic finding in 16% of patients undergoing shoulder arthroscopy and was described as an area of chondromalacia or, depending on the grade of cartilage wear, bare bone beside the bicipital groove. This lesion was thought to be caused by "'maltracking'" of the LHB and was most common with rotator cuff tears and shoulder instability.

Castagna et al[2] and Zappia et al[13] also described an arthroscopic humeral CP sign caused by LHB pressure as an indirect sign of LHB instability. The main location of the CP lesions was at the humeral side, just beside or below the area of the intra-articular portion of the LHB, suggesting a windshield wiper effect of the unstable tendon at the humeral head cartilage.[2]

Patzer et al,[6,8] in their studies, also proposed the concept of a stabilizing function of the LHB and the superior labrum complex for the glenohumeral joint. Thus, injuries of the LHB and its insertion potentially can lead to instability and secondary early osteoarthritis of the shoulder. They also localized these chondral lesions on the humerus underneath the LHB and on the glenoid on the anterior half of the glenoid cavity. They could only associate this humeral head abrasion with SLAP lesions.

Interestingly, Byram et al[1] found associated humeral chondral lesions in failed SLAP repairs but not in untreated SLAP lesions. This humeral head abrasion was preset in 26% of patients they investigated with pain and stiffness after SLAP repairs. The repeat arthroscopy in many of these patients revealed the typically localized chondral abrasion on the humeral head.

This confusing evidence led us to perform this study of 102 consecutive shoulder arthroscopies to investigate the proposed association of the humeral CP with LHB, rotator cuff, or labral pathologies and other chondral lesions.

Materials and methods

We designed a prospective cohort association study of 102 consecutive shoulder arthroscopies to analyze different pathologic shoulder lesions and their association with CP lesions of the humeral head.

Patient assessment and definitions

Between January 2011 and December 2011, the senior author (P.M.A.) performed all arthroscopies. All patients were in the beach chair position under interscalene block or general anesthesia, or both. A systematic standard diagnostic arthroscopy of the glenohumeral joint was followed by the appropriate surgical treatment.

The patients' demographic data, handedness, occupation, and sport activities were collected, and the arthroscopic findings were prospectively recorded by the operating surgeon. This was done using a specifically designed standardized pro forma tailored to investigate proposed associations between CP sign and LHB lesions, rotator cuff and labral pathologies, and other glenohumeral chondral lesions (Fig. 1).

A SLAP lesion was evaluated as previously described.[11] Then the LHB tendon and pulley was assessed to test the stability and the quality of the tendon. We used the Outerbridge[5] classification for the chondral lesions. CP lesions were recorded by location at the entry of the groove or anterosuperior head, their dimensions, and depth. Other chondral lesions of the glenoid and humeral head were recorded by depth and location.

After data collection, 2 observers reviewed intraoperative photographs to confirm the characteristics of the CP lesions, and this was also used to develop a proposed classification.

Statistical analysis

Analysis was a comparison of proportions (with a particular characteristic) between those with and without CP sign. Results are given as differences in proportions with 95% confidence intervals (CIs) and *P* values from the Fisher exact test. Age between CP groups was compared using a 2-sample *t* test reported alongside the difference in means with 95% CI. Age-adjusted analysis was performed using binomial regression models.

Results

The demographic and diagnostic data of all patients is summarized in Table I. We identified 24 patients (23.5%) with

Chondral Print Proforma **No ____**

Name	**Date:**
DOB	**Operator:**
Hosp No	**Operation:**

Demographics

Side	**R**	**L**
Dominance	**R**	**L**
Sex	**M**	**F**
Sport		
Occupation		

EUA

Flexion	
ER (at side)	
ER (at 90^0)	
IR (at 90^0)	
Ant draw	**I II III**
Post draw	**I II III**

Arthroscopy findings:

Superior Labrum	**Morphology**	N Meniscal
	SLAP lesion	I II III IV V
Instability lesions	**Bankart**	Ant Post _ to _
	Hill-Sachs	Ant Post
Rotator cuff tear	**Subscapularis**	N Delam PTT FTT
	SSP	N PTT (A / B) FTT
	ISP	N PTT FTT
	Impingement lesion	No 2 N/A
Glenoid cartilage	**Chondral lesion**	AS PS AI PI
	Grade	I II III IV
Chondral print +'ve	**Depth**	I II III IV
	Location	AS head Entry Groove
	length	mm
	Width	mm
Chondral print –'ve	**Chondral lesion**	I II III IV
Biceps sling		N Frayed Synovitis Stretched
LHB instability	**Subluxation**	Yes No
	Dislocation	I IIa IIb
LHB	**Delamination**	Yes No
	Hourglass	Yes No
	PTT	Deep Superficial
	Rupture	Yes No

Figure 1 The specifically designed standardized pro forma.