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Chondrolysis of the glenohumeral joint following a color test using gentian violet

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Abstract Two patients developed chondrolysis following injection of 0.4% aqueous gentian violet into the glenohumeral joint to visualize a rotator cuff tear during surgery. In both cases, conventional radiographs revealed joint space narrowing 10–12 months after surgery. Histological examination of the humeral heads revealed loss of the articular cartilage.

Résumé Deux patients ont développé une chondrolyse à la suite d'une injection de violet de gentiane à 0.4% dans l'articulation glénohumérale pour visualiser une lésion de la coiffe pendant une intervention. Dans les deux cas, les radiographies conventionnelles ont montrés une diminution de l'interligne articulaire 10–12 mois après la chirurgie. L'examen histologique des têtes humérale a révélé une perte du cartilage articulaire.

Introduction

When a tear in the rotator cuff is small or incomplete, it is often difficult to determine the nature and extent of the tear during surgery. Fukuda et al. [2] reported using a “color test” as an intraoperative staining technique to visualize the nature and extent of the tear. They injected indigo carmine or methylene blue into the glenohumeral joint and reported no apparent complications using these dyes. Here, we report two cases of chondrolysis of the glenohumeral joint following injection of a 0.4% aqueous solution of gentian violet into that joint.

Case studies

Case 1

A 43-year-old woman visited our clinic in 1991 complaining of restricted movement and pain in her right shoulder. Her symptoms appeared 3 months earlier without obvious cause. She presented with a painful arc sign. Conventional radiographs were normal (Fig. 1) and magnetic resonance imaging (MRI) indicated a partial tear of the rotator cuff. Rotator cuff repair was performed 1 year after the patient's first visit to our clinic. During surgery, the extent of the cuff rupture was not apparent when first viewed from the bursal side. The bursal floor appeared smooth but felt softer than the surrounding tendon in the critical portion of the supraspinatus tendon. Therefore, gentian violet in a 0.4% aqueous solution was injected into the glenohumeral joint. The joint side tear of the tendon thus identified was repaired successfully, but after the surgery the patient complained of mild discomfort in her right shoulder during daily activities. The pain continued to increase for 1 year postoperatively, and radiographs showed a markedly narrowed joint space and small bone cysts of the humeral head and the glenoid (Fig. 2).

Seven years after the cuff repair, severe degenerative change was observed in the patient's right shoulder (Fig. 3). The range of motion was restricted and operation with a bicentric humeral prosthesis was performed. Operative findings showed loss of the articular cartilage of most of the humeral head (Fig. 4) and the glenoid fossa. The repaired portion of the rotator cuff was normal, but mild synovitis was observed in the glenohumeral joint. The result of a bacterial culture was negative. Histology of the excised humeral head showed bone necrosis and loss of the articular cartilage (Fig. 5).

Case 2

In 1993, a 32-year-old man suffered from pain in his left shoulder with a clicking sound when lifting heavy objects. Because of positive signs of impingement and arthrographic indications of a joint side tear of the rotator cuff, surgery previously had been performed on his left shoulder. As the extent of the cuff tear could not be clearly determined during surgery, a “color test” was performed using a 0.4% aqueous solution of gentian violet. The joint side tear could be visualized clearly with this procedure and the tear was successfully repaired. Although the patient returned to work 3 months after the operation, he complained of disability of his left shoulder 10 months postoperatively. Conventional radiographs showed joint space narrowing in the shoulder and he then visited our clinic on the advice of his general practitioner. MRI showed no retear of the cuff. Although sodium hyaluronate was injected

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Fig. 1 Case 1. Preoperative anteroposterior view of the right shoulder

Fig. 2 Case 1. Anteroposterior view of the right shoulder 12 months after rotator-cuff surgery using gentian violet

Fig. 3 Case 1. Anteroposterior view of the right shoulder 7 years postoperatively. Severe degenerative changes of the glenohumeral joint are seen

Fig. 4 Case 1. Intraoperative findings of the right humeral head. The articular cartilage of the humeral head disappeared, except for slight remains at the peripheral portion of the head

Fig. 5 Case 1. Histologic finding of the right humeral head. Thinning or loss of the articular cartilage is seen (HE, $\times 50$)

into the glenohumeral joint five times, this provided only temporary relief. The patient's shoulder pain gradually increased, the destructive changes in the glenohumeral joint worsened, and the range of shoulder motion became restricted. Because he was engaged in heavy manual labor, an arthrodesis of the glenohumeral joint was performed 4 years after the primary repair. A test for rheumatoid factor and a bacterial culture were both negative. The intraoperative and histological findings were identical to those of case 1.

Discussion

A joint side tear is usually diagnosed using arthrographic and magnetic resonance imaging. However, when intraoperative findings reveal an intact bursal floor, it is difficult to diagnose the extent of the torn portion of the cuff. In such a situation, Fukuda et al. [2] reported the use of a "color test" consisting of an injection of indigo carmine or methylene blue into the glenohumeral joint to detect and visualize the extent of the joint side tear. They reported no apparent complications in 50 rotator cuff operations, and found no apparent negative effects in the knees of Japanese monkeys upon follow-up histological examinations 18 months after injection of the dye.

Gentian violet has been used in medicine for almost 100 years as an antiseptic for extrinsic use, as an anthelmintic agent by oral administration, and – more recently – as a blood additive to prevent transmission of Chagas' disease [1]. To date, no serious side effects of extrinsic use have been reported. However, oral administration can cause gastrointestinal irritation, and intravenous injection can result in depression of the white blood cell count [1]. Only a few cases of acute toxic side effects after extrinsic use have been reported [5]. A case of se-

vere hemorrhagic cystitis after accidental injection of gentian violet through the urethra has been reported [8]. In animal experiments, acute oral toxicity is evidenced by irritation, congestion and hemorrhaging in the stomach and intestine, and by methemoglobin formation [3]. Gentian violet has also been found to be carcinogenic [4].

Degenerative changes of the shoulder can also result from cuff tear arthropathy, rheumatoid arthritis, infection, and traumatic osteoarthritis. Cuff tear arthropathy and rheumatoid arthropathy were excluded in our reported cases. In addition, bacterial cultures were negative, and there was no past traumatic episode. The distinctive radiographic feature in both cases was a markedly narrowed joint space. In the normal course of osteoarthritis due to aging, joint-space narrowing and osteophyte formation appear concurrently. However, in the two reported cases, narrowing of the joint space occurred about 1 year after the injection of gentian violet. This narrowing was progressive, and destructive changes occurred in the glenohumeral joint despite the successful healing of the repaired cuff. The results in these patients are completely consistent with the findings of Tamai et al. [7] and Nakagawa et al. [6] who suggested that injection of gentian violet into the glenohumeral joint might induce chondrolysis of the joint. We strongly suspect that the

use of intraarticular gentian violet may cause chondrolysis, and we therefore advise against the use of gentian violet during operative rotator cuff repair.

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