



Process and Evaluation Index of Bankart Surgery for the Simulator Development

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Abstract. This paper's purpose is to analyzing the process of Bankart. The reason to analyze this process is that there is various method of the surgery each professional surgeon. So, we have to make a standard of the Bankart Surgery. And we have studied about arthroscopic surgery such as Bankart and Rotator cuff to develop medical simulator for resident education. Because arthroscopic surgery is difficult and complex, it is not easy to learn surgery in the book and they need practical experience as well as theoretical experience. If we complete development of simulator, it helps resident to learn feeling of the 'Bankart' and 'Rotate cuff' surgery. Residents who want to be a professional doctor can't do better than using medical simulator. To give them a detail and actual information, we have classified the process of Bankart and sorted evaluation index in this paper. That's why to analyze the process of Bankart surgery in this paper.

Keywords: Surgery · Education · Bankart repair · Rotator cuff
Shoulder · Simulator · Evaluation index · Arthroscopy · VR

1 Introduction

1.1 Words About Shoulder and Surgery

For understanding this paper, we have to know some of words about body part and understand what is their function.

- Joint pit: A concave surface of two bones forming joints.
- Humerus: A bone that extends from the shoulder to the elbow.
- Biceps: A large muscle in the front part of the upper arm.

Shoulder tissues are composed of important tissue and bone. So this muscle and tissue can rotate our arm. In this paper, there are three important word were explained (Fig. 1).

Humerus

It forms the shoulder joint and the arthritic joint.

The shoulder joint produces six exercise functions consisting of flexion, extension, adduction, abduction, internal rotation and external rotation.

In the joints of the arthritic joints, four exercise functions are created, consisting of flexion, extension, pronation (1), and supination (2).

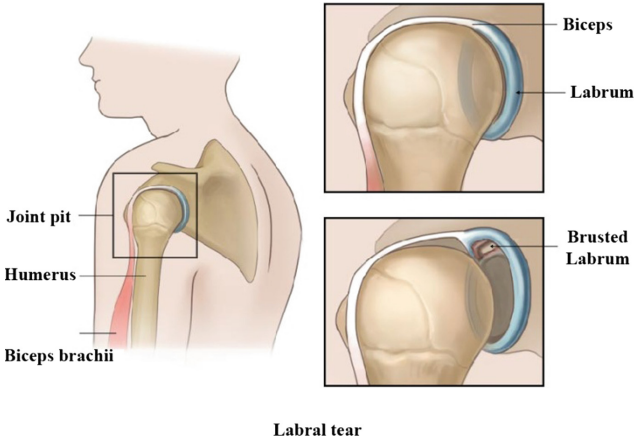


Fig. 1. Explanation of Labral tear.

Biceps brachii

It functions as bending muscles of the lower arm when the lower arm is in the back position. A short one prevents the dislocation of the shoulder joint.

Labrum

It is a fibrous cartilage that surrounds the joints and edges of the scapula from the bones that form the shoulder joints.

A Bankart Shoulder Repair

It is a surgical technique for the repair of recurrent shoulder joint dislocations.

1.2 Explanation About the Bankart

A Bankart Shoulder Repair is a surgical technique for the repair of recurrent shoulder joint dislocations. Within the procedure, the worn out ligaments are re-attached to the proper place in the shoulder joint, using the objective of rebuilding normal function. The shoulder is easily the most commonly dislocated major joint following severe trauma, such as an auto collision or perhaps a fall onto an outstretched arm. Some 96% of dislocations involve the front of the shoulder (anterior), with 1–3% occurring in the back (posterior).

(1) pronation: inner rotate (2) supination: outer rotate (Fig. 2).

Falls and car accidents are common causes of first-time dislocations, but recurrent dislocations in many cases are because of seemingly inoffensive activities such as raising the arm over the head, or combing hair. Shoulder dislocations are more common in males than females, as well as in teenagers rupture can be divided into the case of rupture into the partial layer and the case of rupture into the whole layer.

In particular, the upper joints and the sutures are linked to the biceps in the arms and loosely attached to the bones like the meniscus of the knee joints.

So, it is prone to be relatively damaged.

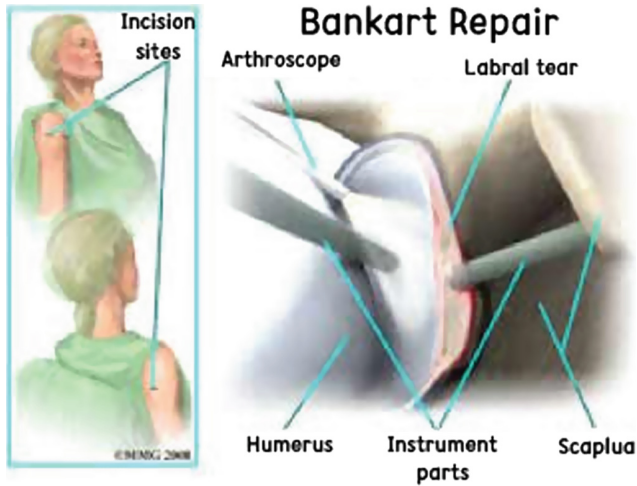


Fig. 2. Bankart shoulder repair for unstable dislocating shoulders

Especially, Bankart lesion is a rupture of the anterior and posteromedial joints, which means the loss of function of the lower and upper brachial ligaments which play the most important role in joint stability.

2 Research Way

2.1 The Step of Research

First, Search the Web and Books

We had to search about the surgery through books and Internet.

In the book, we could tell the difference between the past surgery method and the current surgery method and process. On the internet, we had known to the surgery methods and opinions of other surgery. It solved the problem of limited information that we could only know by a doctor.

Second, Observe the Surgery

We had to observe Bankart and Rotate cuff surgery from surgeon. We realized that the surgical procedure may be changed depending on the patient's condition. We need to record what is the difference of each surgery.

Third, Collect and Analyze Data

We collect and analyze surgery data about Bankart surgery. We determined the evaluation index by recording the appropriate surgical procedure and easy-to-mistake procedure for the patient.

3 Main Subject

3.1 Process of Bankart Surgery

The medical simulator is developed to enable experienced practitioners or practitioners who have little experience in training to directly experience similar operations or procedures.

In addition to the definitions and methods of existing medical simulators, evaluation indicators and reference points, which are essential elements for judging this, and correct surgical procedures are required.

First, we divided process to 4 parts in the Bankart surgery (Fig. 3).

Step1. Check Lesion



Step2. Clean the Lesion



Step3. Insert an Anchor



Step4. make a knot



Fig. 3. Process of bankart shoulder repair

3.2 Evaluation Indexes

Step 1, Check Lesion

First, Surgeon has to insert a scope into the posterior portal.

- [Evaluation index 1] is estimation of the distance to acromion from coracoid.
- [Evaluation index 2] is that finding exactly soft spot and inserting scope smoothly.
- [Evaluation index 3] is that making a portal well to insert other surgical tools.
- [Evaluation index 4] is that spending time to insert needle, mass and other surgical tools. Next, he inserts cannula and check the lesion part by using probe.

Step2, Clean the Lesion

Surgeon has to rip off the tissue from lesion part for clear view by using osteotome (1).

- [Evaluation index 1] are sight to see clearly, and time to spend and he has to remove Bursa by using Shaver then, take care of the bleeding. And then bleed the tissue by using electrocautery (2).
- [Evaluation index 2] are ratio of Bursa in joint pit, and time to spend.
- [Evaluation index 3] is that amount of blood on the tissue.

Step 3, Insert an Anchor

Surgeon has to make a hole in the bone by using Awl.

[Evaluation index 1] is that after taking off Awl, inserting Anchor to bone until mark by using mallet. He has to pass the thread through lesion.

[Evaluation index 2] is estimation of spending time to take out the thread to outside by using Retriever.

[Evaluation index 3] is using Hook, evaluation of pulling the thread through the ring (Fig. 4).

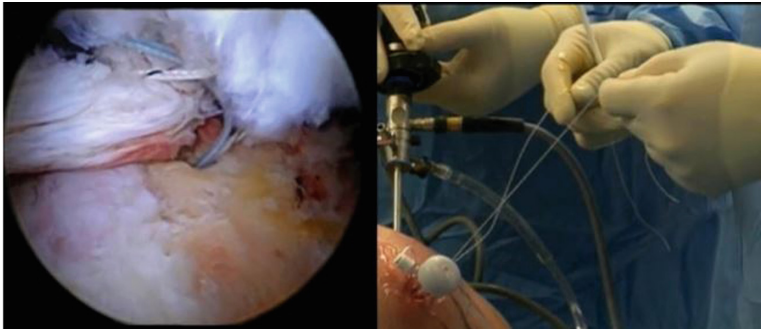


Fig. 4. Inserting anchor to patient in bankart repair

Step 4, Make a knot

Surgeon has to Remove the thread and push a knot.

[Evaluation index 1] is whether the knot is pushed out from the outside and the knot is not twisted to the lesion. He makes a knot repeatedly 2–3 and then cut the knot. Lastly, Remove the extra thread.

[Evaluation index 2] is how to spend time to working and degree of twisted thread. After We have observed some of Bankart surgery, we could find a common things and different things. And then analyzing process and evaluation index.

(1) osteotome: surgical tools to clean the entangled tissue (2) electrocautery: surgical tools used for hemostasis.

4 Result

4.1 Current Achievements and Future Direction

We have studied the process and evaluation index of the surgeons. And this study will be used to help residents learn similar real experiences (Fig. 5).

Currently we are in the process of making a simulator machine and plan to apply the evaluation index here. Through this study, we will provide a variety of surgical environments for residents to help with education.



Fig. 5. Prototype of simulator machine

Acknowledgments. This submission was carried out with support from the research fund of Project for the development of simulator Virtual Surgery Simulator Technology Development for Medical Training. (Project No: 10053260).

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