HORIZONTAL TEAR OF ROTATOR CUFF: ITS MORPHOLOGY AND SURGICAL TREATMENT

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The large horizontal tear is one of the big problems in the repair of the rotator cuff tear. This problem, nevertheless, has not been discussed scrupulously. Though they had been repaired by multiple suturing in situ or by resection of the whole affected tendon and advancement, the results were generally poor. The causes of this poor results were thought to be that multiple suturing in situ did not physiologically reconstruct the damaged tendon, and also that the resection left too large defect to repair in an usual manner (Fig.1).

![Diagram of rotator cuff repair methods]

Fig.1 Multiple Suturing Resection of Torn Portion

Therefore, we have been attempting to observe the fine structure of the horizontal tear and then to reconstruct it into physiological condition according to estimation from the observation. We expected that this method was useful to minimize the resecting portion of the tendon.

CLINICAL CASES

According to the policy previously mentioned, ten rotator cuff repair with anterior acromioplasty had been performed for the large horizontal tear from 1982 to 1984. All of the horizontal tears were larger than 5cm and located in supraspinatus tendon area including infraspinatus tendon to some extent. Cases, the horizontal tears of which were smaller than 5cm, were excluded because of no surgical significance.
There were eight male and two female. The average age was 50 years, ranging from 31 to 69 years. All of the cases had been preoperatively examined by the arthrography. Bursography had been undergone in five cases, arthrograms of which had revealed no abnormal findings. The horizontal tears had been preoperatively diagnosed in six cases by these examinations.

RESULTS OF OBSERVATION AND POSSIBLE PATHOMECHANISM

The horizontal tears were thought to be morphologically classified into two groups. Group I was the flap formation of the surface layer of the tendon on either the bursal or joint side. The thickness of the flap was various, although the most were thin. The floor and roof of the horizontal tear were smooth accompanying no stump of the tendon fiber at the proximal end of the tear. There were two subtypes in this group (Fig. 2).

A type: The flap was formed on the bursal side. Its pathomechanism was thought to be that the surface layers of the tendon were peeled off from the proximal end of the pre-existing bursal side tear by friction with the C-A arch (Fig. 3). Therefore, the thickness of the flap was thought to be decided by the depth of the pre-existing bursal side tear.

B type: The flap was formed on the joint side. It was estimated that, after the avulsion fracture or rim rent, the freed tendon fibers were retracted and separated from the rest of the tendon by muscular power and the friction with the humeral head.

Fig. 2: Subtypes of Group I

Fig. 3
In group II, the proximal end and roof of the horizontal tear was rough and thought to be constituted of stumps of degenerated tendon fibers. On the other hand, the floor was smooth and thought to be made of normal tendon fibers. The thickness of the tendon forming the floor was uniformly one forth or fifths of that of whole tendon. The reason of this uniformity was uncertain. The pathomechanism might be explained as follows. The intermediate fibers of the tendon were torn by severe trauma in the youth (Fig.4) and torn by the daily activity in the elderly due to degenerated change. As a result of the gradual retraction of the torn tendon fibers by the muscular power, a characteristic vacant space was formed (Fig.5). On the both sides of this space, secondary separation between tendon layers occurred along the floor level to some extent due to sideward pulling of neighbor tendons. Because the pulling power was bigger in the proximal than in the distal, secondary separation was larger in the proximal and formed the fun-like extension (Fig.6). This group was divided to three subtypes according to the communication with the subacromial bursa and joint cavity (Fig.7).

Fig.4

Fig.5 : Possible Process Forming Cavity
A type: It might be thought as an original type of this group. There was no communication with the bursa and joint cavity.

B type: there was the communication with the subacromial bursa through the hole of the superficial layers.

C type: there was the communication with both the bursa and joint cavity. We have had no case communicating with joint cavity alone. Because the size of the communicating hole with the subacromial bursa was notably smaller than that of the horizontal tear, the hole was expected to be made afterwards by impingement with the C-A arch.

Out of our ten cases, two cases were classified into Group I type A, one case into type B, and one into Group II type A, two into type B and four type C (Table 1).

![transverse section on the center of the horizontal tear](image)

Fig.6 : Secondary Separation of the Tendon Layers on the Both Sides.

![Fig.7 : Subtypes of Group II](image)

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Table 1: Clinical Cases.

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TREATMENT

In group I, after the anterior acromioplasty, resection of the degenerated portion of the flap and the rest of the tendon and refreshment of the inside of the horizontal tear, both layers of the tendon were reattached together to the refreshed tuberosity in an usual manner with some mattress sutures. These mattress sutures have been put in the proximal end of the horizontal tear (Fig. 8).

Seven cases of group II were repaired by a following technique. At first, the superficial tendon above the horizontal tear was cut off transversely from the tuberosity and longitudinally from the neighbor intact tendons.

The size of formed flap was almost as same as that of horizontal tear. In the distal end of this flap, some stay sutures were put obliquely from the distal of bursal side to the proximal of joint side.

The horizontal tear was enlarged toward the proximal up to the muscular part along the level of the floor. The retracted intermediate fibers were pulled down to its normal position as much as possible. The degenerated portion of tendon was resected. The deep tendon layers forming the floor was trimmed in the same manner to the same shape. Then, the prepared two layers of the tendon was reattached together to the tuberosity in an usual manner with some mattress sutures (Fig. 9).

FOLLOW-UP STUDY

The period of follow-up was from 18 to 49 months, and averaging 25 months. Results had been evaluated as per Wolfgang's criteria. Nine had excellent or good results (Table 2). Another case had poor result with the abnormal ossification in subacromial space. Recently he died because of cancer.

Table 2: Follow-Up

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<tr>
<td>Poor</td>
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CONCLUSIONS

We would like to emphasize that, although there are two groups in the horizontal tear of the rotator cuff, the nature of most of the cases is a tear of the intermediate tendon fibers with retraction. The principle of surgical repair is re-establishment of normal alignment between tendon fibers.