Extravasation of Joint Fluid into the Mediastinum and the Deep Neck during Arthroscopic Shoulder Surgery

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Extravasation of shoulder joint fluid into the surrounding muscles during shoulder arthroscopic surgery is common and inevitable. Here, we report a case of massive extravasation of shoulder joint fluid leading to mediastinal and retrotracheal effusion after arthroscopic shoulder surgery. We will discuss the anatomical basis of fluid leakage from the shoulder to the mediastinum and to the deep neck on CT.

Index terms
Shoulder
Computed Tomography
Surgery
Complication

INTRODUCTION

Although arthroscopic shoulder surgery is a less invasive technique in the diagnosis and treatment of shoulder injuries, complications related to shoulder arthroscopy are reported as 4.6-10.6% (1). Herein, we report a rare case of extravasation of shoulder joint fluid into the mediastinum and the prevertebral space of the neck, a side effect that developed during shoulder arthroscopy. To date, a few cases of severe extravasation that led to airway obstruction have been reported (1-7). None of these previous reports have provided a view of image of this side effect. We reviewed the anatomical basis of fluid leakage from the shoulder to the mediastinum on CT.

CASE REPORT

A 59-year-old woman (weight 46 kg, height 147 cm) with a history of right rotator cuff tear and impingement syndrome underwent subacromial arthroscopic repair and decompression surgery under general anesthesia with endotracheal intubation. The patient was placed in the left lateral decubitus position with the right arm stretched. The anteroinferior portal was inserted near the coracoid process, the anterolateral portal was inserted at the anterolateral corner of the acromion, the lateral portal was inserted 3 cm lateral to the acromion through the deltoid muscle, and the posterior portal (not seen in the figure) was inserted posterolateral to the acromion (Fig. 1). An inflow cannula, a power shaver with suction, and an arthroscope were placed through these ports. The shoulder joint space was then inflated by a pressure pump infusion with normal saline, and the pressure was maintained between 50 cm H$_2$O and 150 cm H$_2$O for the duration of the surgery (2 1/2 hours). As the patient was found to have both synovitis of the glenohumeral joint and impingement syndrome, the arthroscope and the other instruments were inserted into both the glenohumeral joint space and the subacromial space. At the end of the surgery, a drainage catheter was placed in the subacromial space. Immediately following the surgery, the patient had marked swelling across the entire chest and the neck on the right side. Chest radiography revealed dense opacification of the right hemithorax with swelling of the...
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According to a chest CT scan, a large amount of fluid accumulation occurred in the subcutaneous area of the anterior chest wall, superficial to the pectoralis major muscle on both sides (Fig. 2A). The chest CT scan also showed fluid density permeation in the interpectoral and retropectoral areas, deep into the latissimus dorsi muscle and the subcutaneous area of the posterior chest wall. The fluid in the axillary space tracked into the mediastinum, the retropharyngeal space of the neck, and the right posterior cervical space, and up into the submandibular space under the platysma muscle (Fig. 2B). A thin-section CT scan of the lungs showed smooth interlobular septal thickening in the right apex (Fig. 2C) along with a small amount of pleural effusion on the right side (not seen). Despite severe swelling of the neck, the patient did not complain of dyspnea or chest discomfort, but instead complained of pain in the surgical wound. On the day after the surgery, there was a drainage of about 360 mL of fluid through the catheter in the subacromial space. The chest CT scan, which was performed 24 hours following surgery, revealed a complete resolution of mediastinal and retrotracheal effusion, and nearly a complete absorption of subcutaneous fluid loculation in the anterior chest wall.

DISCUSSION

Extravasation of joint fluid into surrounding deltoid muscle during arthroscopic shoulder surgery is common, inevitable and reported to be safe (8). A few cases of massive fluid leakage leading to tracheal compression have been reported. Despite experiencing airway compromise, a life threatening event, all the patients recovered within 24 hours after the surgery, as the patient of this study recovered completely (1-7). The risk factors for extensive fluid leakage include high pump pressure, massive irrigation fluid, obesity, a prolonged arthroscopic procedure, lateral positioning, technical ability, acromioplasty, surgical resec-

Fig. 1. Spaces of potential fluid leakage from the shoulder. Fluid extravasation occurs when arthroscopic shoulder surgery is performed at the subacromial space. Three ports were inserted near the acromion [anterolateral, posterior (not seen in the figure), and lateral to the acromion], and the anteroinferior port was inserted near the coracoid process. Spaces of potential fluid leakage are along the margin of the deltoid muscle and through the arthroscopic port that penetrates the deltoid muscle (arrows). A large amount of fluid might have accumulated in the subcutaneous fat anterior to the pectoralis major muscle in this course.

Fig. 2. Fluid leakage during shoulder arthroscopy in a 59-year-old woman.
A. Enhanced chest CT scan shows a large amount of fluid accumulation in the subcutaneous fat layer of the anterior chest wall (star). Fluid is also noted in the posterior chest wall, permeating the right rhomboid and the right latissimusdorsi muscles (arrows).
B. Enhanced chest CT scan at the level of the upper neck shows fluid in the retropharyngeal space (star), right posterior cervical space (triangle), and right submandibular space (square). Fluid splayed between the carotid space and anterior scalene muscle to enter into the retropharyngeal space of the neck (arrow).
C. Thin-section CT scan of the lung shows smooth interlobular septal thickening in the right apex and the focal ground glass opacity in left apex medial aspect (arrow).
D. Coronal-reformatted chest CT scan shows that the fluid around the subclavian vein continues to the mediastinum (arrows).
The Pathway of Fluid Leakage from the Shoulder

The shoulder joint has a thick capsule, and there is little extravasation of fluid during routine arthroscopy of the glenohumeral joint. However, there is no definite capsule or barrier at the subacromial space (8). Our patient also underwent acromioplasty, which was performed at subacromial space. The tip of the arthroscope and the instruments for inflow and outflow of fluid were placed in the subacromial space. There are several spaces along the margin of the deltoid muscle and along the arthroscopic port penetrating the deltoid muscle, where leakage of fluid could potentially occur (Fig. 1). A large amount of fluid was assumed to have accumulated in the subcutaneous fat superficial to the pectoralis major muscle on this path (Fig. 2A).

Leakage Deep into the Mediastinum and Retropharyngeal Space of the Neck

The fluid in the subacromial space may have spread down along the joint capsule to reach the axillary space. The fluid tracked deep into the mediastinum, along with axillary and subclavian vessels as shown on the chest CT scan (Fig. 2D). The fluid cannot spread directly into the deep neck because the posterior cervical space is covered with deep cervical neck fascia. In the same way, the fluid leaked into the mediastinum, and as a result, it may have tracked the subclavian vessels to reach the right posterior cervical space. Subsequently, the fluid splayed a deep layer of the deep cervical fascia between the carotid space and the anterior scalene muscle in order to spread deep into the danger space of the neck (Fig. 2B). The danger space continues inferiorly into the mediastinum. The danger space is separated from the retropharyngeal space by alar fascia; otherwise, it is impossible to discriminate between the two spaces on an image (9).

Pleural Cavity and Interstitial Edema

A chest CT scan showed a small amount of right pleural effusion with interstitial pulmonary edema at both apices (Fig. 2C). Orebaugh (5) reported a case of massive pleural effusion with atelectasis secondary to fluid extravasation. Further, a few cases of pneumothorax with a pneumomediastinum, following shoulder arthroscopy, have been reported previously (2). It is presumed that further rise in the mediastinal pressure, which might be combined with a pneumomediastinum during expiration or positive pressure ventilation, might cause the mediastinal parietal pleura to rupture (2). As our case indicated a small amount of effusion combined with edema at the apex, we presumed that the development of edema and effusion were due to lymphatic stasis rather than a pleural rupture. Because the lymphatic fluid from the cervical parietal pleura (pleura at the apex) drains into the lymph nodes of the axilla, this patient may have had lymphatic stasis at the right axillary level due to a massive amount of subcutaneous fluid collection (10).

In conclusion, we have reported a side effect case of extravasation of shoulder joint fluid into the mediastinum and the prevertebral space of the neck during shoulder arthroscopy. Chest CT scan can be helpful in understanding the anatomy of massive fluid extravasation from the shoulder to the deep neck and the mediastinum, although fascial and compartmental structures are complex.

REFERENCES

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