



## Pneumothorax after shoulder arthroscopy: a case report and literature review



Dezhou Tang<sup>a,†</sup>, Qian Liu, MD<sup>a,†</sup>, Chen Chen, MD<sup>b</sup>, Weihong Zhu, MD<sup>a,\*</sup>

<sup>a</sup>Department of Orthopaedics, The Second Xiangya Hospital, Central South University, Changsha, P. R. China

<sup>b</sup>Department of Thoracic Surgery, The Second Xiangya Hospital, Central South University, Changsha, P. R. China

### ARTICLE INFO

#### Keywords:

Shoulder arthroscopy  
complication  
pneumothorax

Arthroscopic surgery can effectively improve the pathologic changes and pain of the shoulder joint and shorten the recovery period after the operation.<sup>13,16</sup> It has greatly improved the surgical skills of surgeons, and now, it is becoming more and more widely accepted.<sup>6</sup> The incidence of complications after arthroscopic shoulder surgery is relatively rare, such as axillary nerve injury, infection, thrombosis, compartment syndrome, pulmonary edema, cerebral infarction, pneumothorax, and so on.<sup>18</sup> Pneumothorax after shoulder arthroscopy is a dangerous potential complication.<sup>4</sup> Patients with pneumothorax often present with shortness of breath, dyspnea, respiratory distress, hypoxemia, reduced ipsilateral air entry, and percussion hyperresonance.<sup>5,14</sup> Cardiac arrest may occur if it is not diagnosed and treated in time.<sup>15</sup>

We reviewed 1140 cases of shoulder arthroscopic surgeries in our hospital from January 2015 to December 2019. We found 2 cases of postoperative pneumothorax in which timely diagnosis was made and effective treatment was adopted to avoid catastrophic consequences. Herein, we reported our experiences that successfully rescued patients from spontaneous or tension pneumothorax after arthroscopic shoulder surgery. Before reporting the case, we had obtained the patients' consent.

### Case report one

A 24-year-old man was admitted to our department. He complained of anterior pain and apprehension of the right shoulder after initial shoulder dislocation 6 years ago. He had approximately

10 instability episodes after his initial dislocation. The physical examination showed anterior tenderness of the shoulder and a positive anterior apprehension test. The AP shoulder radiograph was normal. Magnetic resonance imaging showed an anteroinferior labral lesion (Fig. 1, A). Computerized tomography scan showed no obvious bone loss of the glenoid and humeral head. He had no history of surgery but a smoking history of more than 7 years (1 pack/day). To distinguish whether there was lung disease or not,<sup>4</sup> we arranged a preoperative chest X-ray examination for him, and the result was normal (Fig. 2, A).

An arthroscopic standard Bankart repair was scheduled for him. No interscalene nerve block was performed. After general anesthesia, he was placed in a lateral decubitus, the arm abducted 30° and anteriorly flexed 15° with axial traction of 6 kg. This allows for better visibility and maneuverability.<sup>11</sup> Anteroinferior labral tear was found through the routine posterior portal. The torn labrum was reattached to the glenoid rim by securing with four suture anchors (2.8-mm Twinfix, Smith & Nephew, A Dover, MA, USA) (Fig. 1, B and C).

His vital signs were stable, and the postoperative resuscitation was uneventful. However, he suddenly had serious restlessness 2 hours of the surgery. Sweating and dyspnea were accompanied by rapidly decreased oxygen saturation. Physical examination revealed subcutaneous emphysema, fullness, and widening of rib space in his upper right chest. There were tympanic sounds in the right chest percussion and disappearance of breath sound in auscultation. A diagnosis of tension pneumothorax was made. The cardiothoracic surgeon immediately used the No. 20 needle to perform closed thoracic drainage at the third intercostal space of the right midline of the clavicle (Fig. 2, B). His symptoms were significantly alleviated after the urgent operation with a chest tube placed 15 minutes later.

Two days later, the right lung returned to normal (Fig. 2, C). He had no pulmonary discomfort or recurrent dislocation during the 3-year follow-up. He had returned to his preinjury level of sports.

Institutional review board approval was not required for this case report. Consent was received from all cases reported in this article.

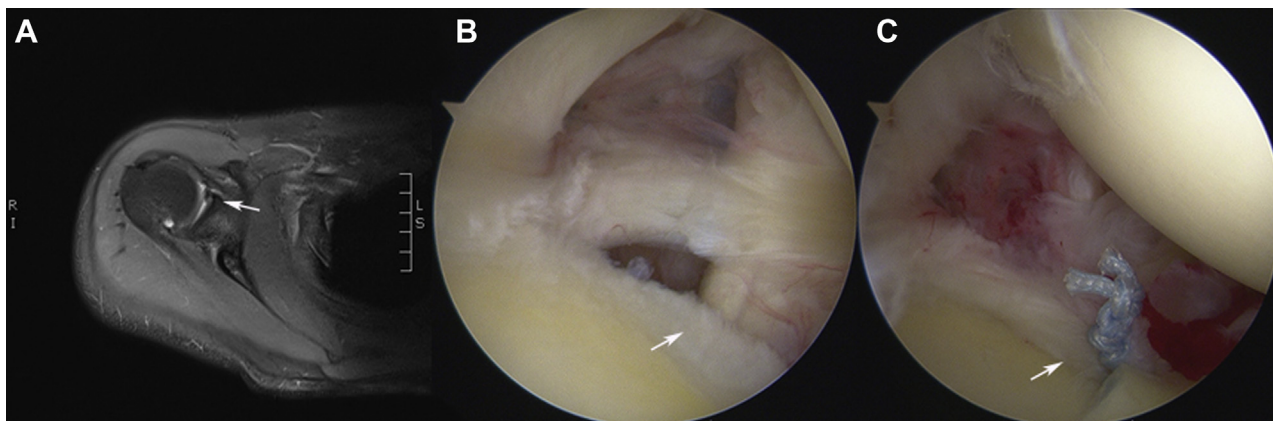
\* Corresponding author: Weihong Zhu, MD, Department of Orthopaedics, The Second Xiangya Hospital, Central South University, No. 139, Middle of Renmin Road, Changsha, P. R. China 410011.

E-mail address: [zhuweihong@csu.edu.cn](mailto:zhuweihong@csu.edu.cn) (W. Zhu).

† These authors contributed equally to this article.

<https://doi.org/10.1016/j.xrrt.2021.04.003>

2666-6391/© 2021 The Authors. Published by Elsevier Inc. on behalf of American Shoulder & Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



**Figure 1** (A) Preoperative magnetic resonance imaging anteroinferior labral lesion (White arrows); (B) Arthroscopy inspection showed obvious anteroinferior labrum lesion (White arrow); (C) Anteroinferior labrum reattached to the glenoid rim after Bankart repair (White arrow).



**Figure 2** (A) Preoperative chest radiograph was normal; (B) Thoracocentesis was immediately performed using a 20-gauge needle; (C). Chest radiograph was normal 2 days after closed thoracic drainage.

**Case report two**

A 60-year-old woman was admitted to our department owing to pain and discomfort of her right shoulder for half a year. Physical examination demonstrated limited abduction and positive Neer test, Hawkins test as well as Jobe’s test, and magnetic resonance imaging showed a supraspinatus tendon lesion (Fig. 3, A). She was thin and had no history of smoking, chronic obstructive pulmonary disease, asthma, or other lung diseases. Preoperative chest radiographs were also normal (Fig. 4, A).

The surgeon performed a shoulder arthroscopy under general anesthesia. There was no nerve block. The full-thickness rotator cuff tear was observed under arthroscopy (Fig. 3, B). From the anterosuperior portal, double-row suture fashion (4.5-mm Healicoil PK suture anchor for medial row, 5.5-mm Footprint Ultra PK suture anchor for lateral row; Smith & Nephew, Andover, MA, USA) was used to repair the ruptured supraspinatus tendon (Fig. 3, C).

The blood pressure and oxyhemoglobin saturation were normal during the operation. She was routinely sent back to the ward from the recovery room, and the vital signs were stable. After the operation, she was examined by X-ray, and the compression of right chest lung was obvious (Fig. 4, B). However, her vital signs were stable, and there were no symptoms of tightness or dyspnea. She was immediately scheduled for a plain computerized tomography scan of the lungs,<sup>15</sup> and the results show that 90% of the right lung was compressed (Fig. 4, C).

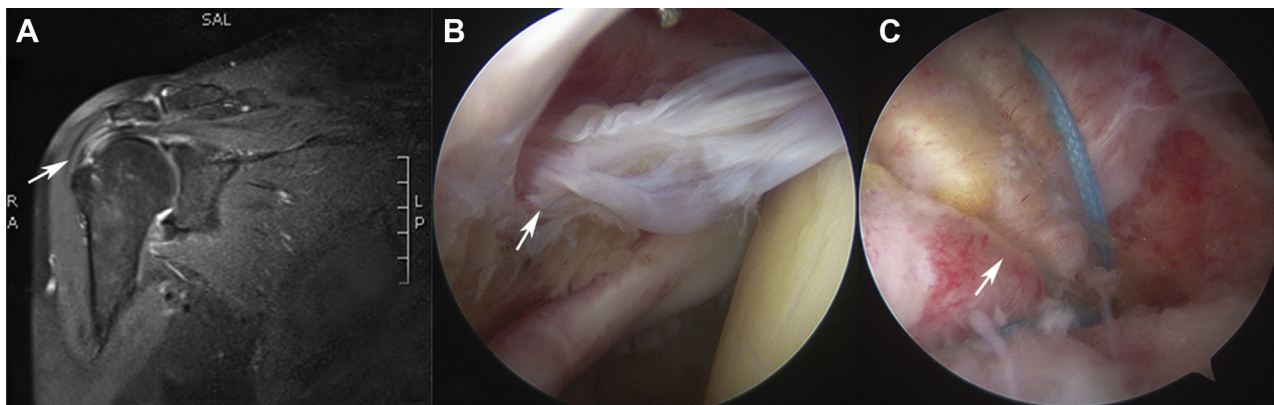
She was immediately treated with closed thoracic drainage. The drainage tube was removed on the third day after the operation (Fig. 4, D). She received standard rehabilitation protocol after discharge. At present, she returned to normal daily life without any discomfort after the 2-year follow-up.

**Discussion**

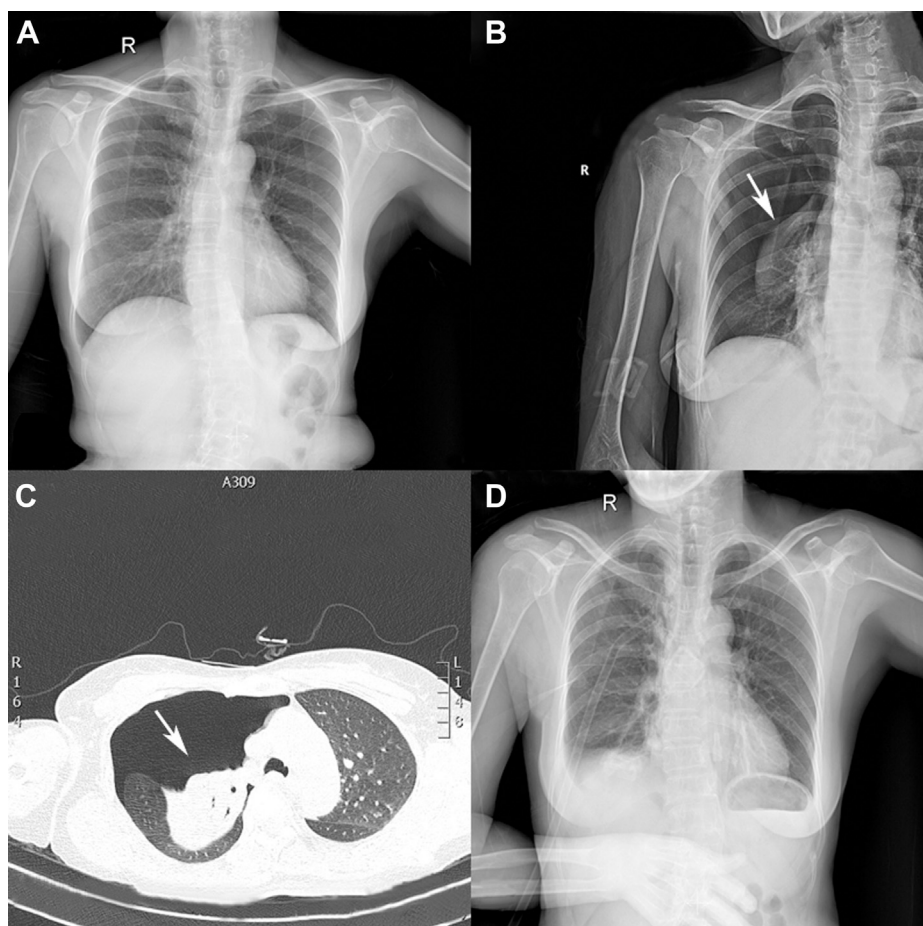
Arthroscopic surgery is a safe and effective approach to address recurrent anterior shoulder instability and rotator cuff injury. It is associated with few postsurgical complications, such as neurovascular injury, infection, thrombosis, cerebral infarction, or pneumothorax.<sup>18</sup> These complications are uncommon in clinical practice, but they are troublesome and even potentially life-threatening when they occur. Among these complications, pneumothorax is extremely rare and could lead to immediately abnormal pleural pressure, mediastinum swing to the healthy side, venous reflux disorder, and even cardiopulmonary arrest which requires urgent treatment.<sup>15</sup>

In our cases, we consider that the causes of postoperative pneumothorax are as follows:

- (1) Iatrogenic factors: Oskar et al<sup>8</sup> and Robert et al<sup>10</sup> believe that brachial plexus block is also a potential factor of pneumothorax, which often occurs during operation. Our patient did not have a nerve block, so we do not think it is a major cause of pneumothorax. Mohammad et al<sup>17</sup> proposed



**Figure 3** (A) Preoperative MRI showed torn supraspinatus tendon (White arrows). (B) Arthroscopy inspection showed obvious rotator cuff rupture (White arrows). (C) The image after arthroscopic repair (White arrows). MRI, magnetic resonance imaging.



**Figure 4** (A) Preoperative chest radiograph was normal. (B) Postoperative chest radiograph indicated compression in the Right lung. (C) The CT scan of the lung shows severe atrophy of the Right lung (White arrow). (D) The reexamination after closed thoracic drainage indicated that the compressed Right lung almost returned to normal. CT, computerized tomography.

that trauma caused by instruments during shoulder arthroscopic surgery can also cause pneumothorax. Calvisi et al<sup>3</sup> and Lee HC et al<sup>9</sup> emphasized that the change of pressure in the subacromial space and the entry of air into the tissue during shoulder arthroscopy may also be a factor related to spontaneous pneumothorax. As we had taken

good preventive measures during the operation, we believe that this factor is not highly related to the occurrence of pneumothorax in our patients.  
 (2) Traction: We noticed that pneumothorax occurred at the ipsilateral lung, which may be related to our routinely used lateral decubitus position. We postulated that the continuous



axial traction could increase the laxity of the junction around the shoulder and chest wall which might induce pneumothorax.

- (3) Smoking: Bense et al<sup>1</sup> investigated the relationship between smoking and spontaneous pneumothorax. They found that people with a history of smoking had a significantly higher risk of developing spontaneous pneumothorax. Patients who smoked heavily had a 12% risk of developing spontaneous pneumothorax. In contrast, men who never smoked had a 1/1000 chance of developing a spontaneous pneumothorax.
- (4) Age: Antonio et al<sup>2</sup> described the correlation among age, gender, and spontaneous pneumothorax and believed that gender and age are crucial factors for the occurrence of spontaneous pneumothorax.
- (5) As well known, lanky stature and lower body mass index (BMI) could be an potential cause of pneumothorax.<sup>20</sup> In our cases, the BMI is 17.0 and 17.2 for the male and female patients, respectively. The BMI of both patients was lower than the low value of normal BMI. Besides, lung diseases and a history of chest trauma may be risk factors for pneumothorax.<sup>19</sup>

Although we cannot provide an explicit explanation for our cases, it is believed that the main cause of pneumothorax is multifactorial, including iatrogenic factors, traction, age, history of smoking, lung diseases and chest trauma, and so on. It should be noted that the onset in the first patient was very urgent, but the onset in the second patient was insidious. These variances remind us that careful inspection and the ability to make timely and accurate decisions is crucial. For patients with long operation time, swelling of the chest and neck, and low arterial oxygen saturation after operation, chest X-ray should be performed after operation.<sup>7</sup> But, the first thing that needs to be considered is whether the patient has access to X-rays.

As an orthopedic surgeon, it requires not only surgical skills but also a comprehensive knowledge of medicine to manage post-operative emergency complications such as pneumothorax. In our cases, there are two reasons for successful rescue: one is immediate identification of the pneumothorax and the other one is rapid implementation of effective treatment.<sup>12</sup> As a famous Chinese medical expert, Xiaoqian Zhang once said: “The road to practice medicine, as though on the brinks of an abyss, as though treading on thin ice.”

## Conclusion

Pneumothorax after shoulder arthroscopy is an emergent and disastrous complication. It is necessary to carry out preoperative and postoperative imaging examinations for special patients. The orthopedic surgeon should be aware of potential tension or spontaneous pneumothorax after shoulder arthroscopy and initiate timely management as soon as possible to avoid catastrophic consequences.

## Disclaimers

Funding: No funding was disclosed by the author(s).

Conflicts of interest: The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Patient consent: Obtained.

## References

1. Bense L, Eklund G, Wiman LG. Smoking and the increased risk of contracting spontaneous pneumothorax. *Chest* 1987;92:1009-12.
2. Bobbio A, Dechartres A, Bouam S, Damotte D, Rabbat A, Regnard JF, et al. Epidemiology of spontaneous pneumothorax: gender-related differences. *Thorax* 2015;70:653-8. <https://doi.org/10.1136/thoraxjnl-2014-206577>.
3. Calvisi V, Lupporelli S, Rossetti S. Subcutaneous emphysema and pneumomediastinum following shoulder arthroscopy with brachial plexus block: a case report and review of the literature. *Arch Orthop Trauma Surg* 2009;129:349-52. <https://doi.org/10.1007/s00402-008-0593-y>.
4. Dietzel DP, Ciullo JV. Spontaneous pneumothorax after shoulder arthroscopy: a report of four cases. *Arthroscopy* 1996;12:99-102.
5. Huang TJ, Ahmed A, D'Souza D, Awad H. Delayed diagnosis of contralateral tension pneumothorax during robotic lung wedge resection. *J Clin Anesth* 2018;45:30-1. <https://doi.org/10.1016/j.jclinane.2017.11.023>.
6. Iyengar JJ, Samagh SP, Schairer W, Singh G, Valone FH 3rd, Feeley BT. Current trends in rotator cuff repair: surgical technique, setting, and cost. *Arthroscopy* 2014;30:284-8. <https://doi.org/10.1016/j.arthro.2013.11.018>.
7. Kim JB, Choi MK, Jeon YK, Lee JM. Chest wall swelling and pneumothorax after shoulder arthroscopy: Were the 2 events totally independent? *Medicine (Baltimore)* 2017;96:e7020. <https://doi.org/10.1097/MD.00000000000007020>.
8. Leander-Olsson O, Borglund-Hemph A, Jakobsson JG. Pneumothorax following shoulder arthroscopy under combined regional and general anaesthesia-A case report. *Int J Surg Case Rep* 2016;24:73-6. <https://doi.org/10.1016/j.ijscr.2016.05.012>.
9. Lee HC, Dewan N, Crosby L. Subcutaneous emphysema, pneumomediastinum, and potentially life-threatening tension pneumothorax. Pulmonary complications from arthroscopic shoulder decompression. *Chest* 1992;101:1265-7.
10. Li R, Lall A, Lai E, Gruson KI. Tension pneumothorax after ultrasound-guided interscalene block and shoulder arthroscopy. *Am J Orthop (Belle Mead NJ)* 2015;44:E407-10.
11. Li X, Eichinger JK, Hartshorn T, Zhou H, Matzkin EG, Warner JP. A comparison of the lateral decubitus and beach-chair positions for shoulder surgery: advantages and complications. *J Am Acad Orthop Surg* 2015;23:18-28. <https://doi.org/10.5435/JAAOS-23-01-18>.
12. MacDuff A, Arnold A, Harvey J, Group BTSPPG. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;65:ii18-31. <https://doi.org/10.1136/thx.2010.136986>.
13. Mall NA, Chahal J, Heard WM, Bach BR Jr, Bush-Joseph CA, Romeo AA, et al. Outcomes of arthroscopic and open surgical repair of isolated subscapularis tendon tears. *Arthroscopy* 2012;28:1306-14. <https://doi.org/10.1016/j.arthro.2012.02.018>.
14. Noppen M, De Keukeleire T. Pneumothorax. *Respiration* 2008;76:121-7. <https://doi.org/10.1159/000135932>.
15. Roberts DJ, Leigh-Smith S, Faris PD, Blackmore C, Ball CG, Robertson HL, et al. Clinical presentation of patients with tension pneumothorax: a systematic review. *Ann Surg* 2015;261:1068-78. <https://doi.org/10.1097/SLA.0000000000001073>.
16. Schmidt CC, Jarrett CD, Brown BT. Management of rotator cuff tears. *J Hand Surg Am* 2015;40:399-408. <https://doi.org/10.1016/j.jhssa.2014.06.122>.
17. Shariyate MJ, Kachooei AR, Ebrahimzadeh MH. Massive emphysema and pneumothorax following shoulder arthroscopy under general anaesthesia: a case report. *Arch Bone Joint Surg* 2017;5:459-63.
18. Shin JJ, Popchak AJ, Musahl V, Irrgang JJ, Lin A. Complications after arthroscopic shoulder surgery: a review of the American Board of Orthopaedic Surgery database. *J Am Acad Orthop Surg Glob Res Rev* 2018;2:e093. <https://doi.org/10.5435/JAAOSGlobal-D-18-00093>.
19. Vezzani A, Manca T, Brusasco C, Santori G, Valentino M, Nicolini F, et al. Diagnostic value of chest ultrasound after cardiac surgery: a comparison with chest X-ray and auscultation. *J Cardiothorac Vasc Anesth* 2014;28:1527-32. <https://doi.org/10.1053/j.jvca.2014.04.012>.
20. Walker SP, Bibby AC, Halford P, Staddon L, White P, Maskell NA. Recurrence rates in primary spontaneous pneumothorax: a systematic review and meta-analysis. *Eur Respir J* 2018;52. <https://doi.org/10.1183/13993003.00864-2018>.