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Case Report

Diffuse intravascular coagulation after a shoulder arthroscopic surgery for rotator cuff tear: a case report and literature review

Youqiang Sun[1], Wanjun Liu[2], Mengmeng Liang[3], Ding Guo[1], Shuangxiao Zhang[1], Hua Zhang[1], Baogui Deng[1], Xiaobing Xiang[1]

[1]Department of The Sports Medicine, The First Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, P. R. China; [2]Guangzhou Vocational and Technical University of Science and Technology, Guangzhou, Guangdong, P. R. China; [3]Department of Obstetrics, Guangdong Women and Children Hospital, Guangzhou, Guangdong, P. R. China

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Abstract: Background: Shoulder arthroscopic surgery is considered to be the standard surgery for rotator cuff tear (RCT) as it has the advantages of being minimally invasive with less trauma, less bleeding, and faster recovery. The incidence of complications increases as the complexity of shoulder arthroscopic surgery increases. Disseminated intravascular coagulation (DIC) is a disease caused by systemic activation of coagulation, which will finally develop into multiple organ dysfunction. This case is rare as the DIC seldom happens in a RCT operation. We retrospectively analyzed the data in order to explore the clinical characteristics, diagnosis and treatment methods of DIC before and after shoulder arthroscopic surgery. Case presentation: A 60-year-old female patient was admitted to the hospital for RCT and underwent an arthroscopic surgery. Her intra-operative operation was successful without unexpected episodes. However, the patient suffered from massive postoperative bleeding due to DIC. A series of treatments of anticoagulation, alternative therapy, shock prevention, and microcirculation improvement were given. The patient's condition went back to stable and she was discharged on the 20th day postoperatively. Conclusion: For patients with abnormal coagulation function before the arthroscopic operation, the supplementation of fibrinogen to a normal value is recommended. Patients with recurrent and massive bleeding after surgery should routinely be checkedfor DIC to achieve an early treatment. Once postoperative DIC was found, immediately coagulation function and risk of thrombosis should be assessed, and the proper treatment should be applied to stabilize the patient's vital signs to prevent hemorrhagic shock.

Keywords: Shoulder arthroscopy, rotator cuff tear, diffuse intravascular coagulation

Introduction

Rotator cuff tear (RCT) is one of the most common causes of shoulder pain and dysfunction in adults. It mainly caused by a long-term degenerative injury or trauma and mostly occurs in middle-aged and elderly patients [1, 2]. According to related reports, more than 40% of people over the age of 60 are suffering from rotator cuff injury. These RCT patients often have shoulder dysfunctions and can severely affect the quality of life [3].

The rotator cuff is composed of four muscles: the supraspinatus muscle, the infraspinatus muscle, the subscapularis muscle, and the teres minor muscle. It wraps around the humerus head to form a sleeve-like structure, which maintains various activities of the shoulder. Once the rotator cuff tears, there is almost no possibility of self-healing [4]. For those severe rotator cuff tears, surgery is needed [5]. In the past 20 to 30 years, with the rapid development of arthroscopic technology, the number of rotator cuff repair surgery increased. Arthroscopic rotator cuff repair has also become the standard for the treatment of RCT. Approximately 250,000 cases of rotator cuff repair are performed arthroscopically in the United States each year. As the complexity of

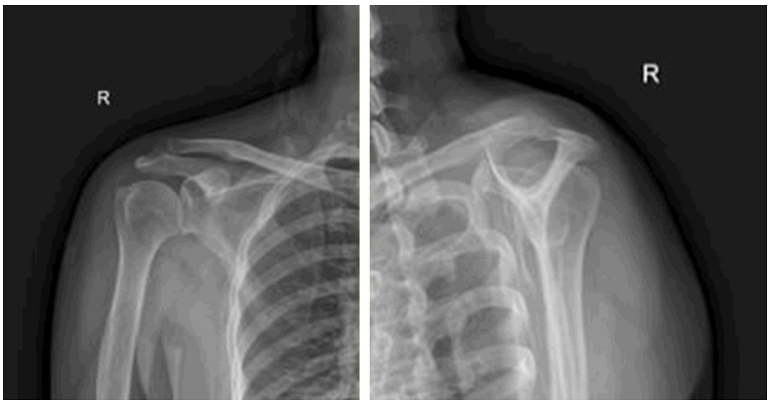

Figure 1. X-rays of Right shoulder before surgery. There is degeneration in the humeral head and scapula glenoid cartilage, and a hyperplasia in the right acromion with a type II acromion.

the surgery increases, the incidence of complications also increases [6, 7]. In 1986, Small [8] reported the complication rate for the first time on a large scale experiment. Among 14329 cases of shoulder arthroscopic operation, the complication rate of the fibrocystic lesion was 5.3%, while the complication rate of subacromial surgery was only 0.76%. According to recent studies, the incidence of postoperative complications of shoulder arthroscopy is 1% to 2%. The incidence of deep vein thrombosis and pulmonary embolism is 0.06% to 0.42%, while the incidence of deep infection is 0.16%~1.9%. Although these complications are rare, they will endanger the lives of patients [9, 10].

Disseminated intravascular coagulation (DIC) is a disease caused by systemic activation of coagulation, which may cause small and medium blood vessels to occlude, thereby causing multiple organ dysfunction [11]. It has been reported that the incidence of DIC in cancer patients ranges from 10% to 15%, manifesting as chronic or acute [12]. It rarely occurs in shoulder arthroscopic surgery and we did not find any report about DIC after RCT operation. Therefore, early diagnosis of DIC is of great importance to reduce the mortality of patients [13]. This study retrospectively analyzed the data of a case of DIC after the arthroscopic surgery of rotator cuff repair. The purpose of this study was to explore the clinical characteristics, diagnosis results and treatment methods of DIC after the rotator cuff repair. The case might provide us clinical guidance when we face a DIC situation with shoulder arthroscopic surgery. The summary report of the case is as follows.

Case presentation

In July 2019, a 60-year-old female patient was admitted to hospital due to “right shoulder joint pain for more than half a year”, there was no obvious inducement for her right shoulder pain. The pain worsened at night and in activities. She did not pay much attention to that, and her symptoms were repeated and worsened. Magnetic resonance imaging (MRI) showed she had a rotator cuff tear. She underwent conservative treatments such as cortisone injection and drugs but eventually obtained poor results. The patient was admitted to our department for further treatment. The physical examination showed no local swelling of the right shoulder joint, with normal skin temperature. The local tenderness (-), Jobe test (+), Bear hug test (+), Abdominal compression test (+), and Speed test (+). Combining the physical examination and imaging findings, the patient was diagnosed with right rotator cuff injury. The preoperative X-rays and MRI are shown in **Figure 1** (**Figure 1**: X-rays of Right shoulder before surgery. There is degeneration in the humeral head and scapula glenoid cartilage, and a hyperplasia in the right acromion with a type II acromion) and **Figure 2** (**Figure 2**: MRI of the right shoulder before surgery. The right supraspinatus tendon was torn and withdrawn slightly with local congestion. Longitudinal tears were seen in 2/3 of the subscapularis tendon). The laboratory examination showed 77 U/L of alanine aminotransferase and 60 U/L of aspartate aminotransferase; 15.4 mg/L of C-reactive protein; 1.04 g/L of fibrinogen; and there were no obvious abnormalities. Surgery contraindications were ruled out, the right shoulder was clean, acromion shaping and rotator cuff repair procedures were performed arthroscopically. During the operation, we saw hyperplasia of the synovium in the right shoulder joint, a degeneration of the humeral head and scapula glenoid cartilage, hyperplasia of the right acromion with a type II acromion. The right scapula rotator cuff was torn and

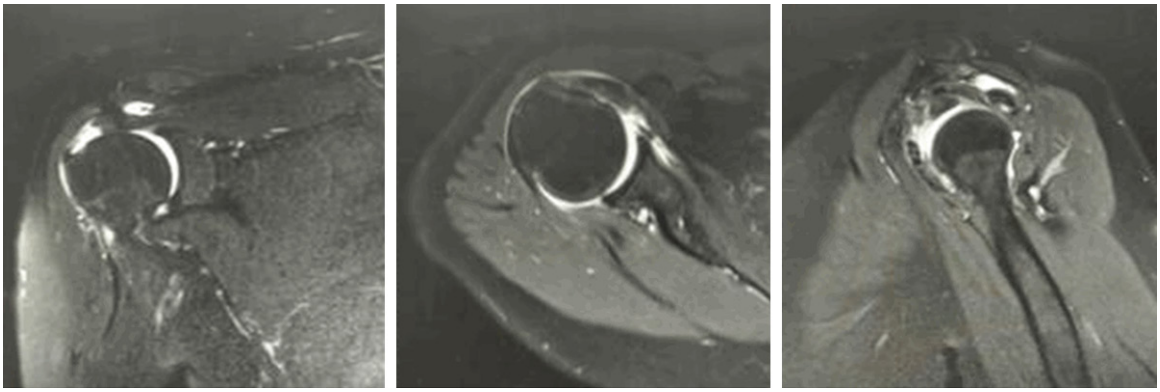

Figure 2. MRI of the right shoulder before surgery. The right supraspinatus tendon was torn and withdrawn slightly with local congestion. Longitudinal tears were seen in 2/3 of the subscapularis tendon, with no obvious retraction.

Figure 3. X-rays of right shoulder after surgery. The acromion is flat and with a normal distance of acromion-humeral head in the X-rays of right shoulder after surgery.

withdrawn slightly with local congestion. Longitudinal tears were seen in 2/3 of the subscapularis muscle, with no obvious retraction. The upper layers of the supraspinatus were sutured with two thread anchors (5.0 mm×15 mm, titanium, Smith & Nephew) in a single row. Besides, a footprint anchor (4.75 mm× 19.1 mm, Arthrex) was inserted into the lateral of the greater tubercle. Two anchors (5.0 mm×15 mm, titanium, Smith & Nephew) were used to fix the subscapularis inline and a lateral anchor (4.75 mm×19.1 mm, Arthrex) was fixed to the footprint. The whole operation time was 210 minutes. Postoperatively, the patient was treated with electrocardiography (ECG) monitoring, liquid supply, pain relief, stomach protection, and infection prevention. The image of postoperative X-rays and MRI were shown in **Figure 3** (**Figure 3**: X-rays of right shoulder after surgery. The acromion is flat and with a normal distance of acromion-humeral head in the X-rays of right shoulder after surgery) and **Figure 4** (**Figure 4**: The supraspinatus and subscapularis tendons are complete and continuous without any retraction. The distance of the acromion-humeral head is normal).

Twelve hours after the surgery, the patient's wound began to show a large amount of bleeding. After hemostatic treatment, a DIC blood test was performed. Ninteen hours after the operation, the patient was diagnosed with DIC (According to the International Society of Thrombosis and Hemostasis (ISTH), the ISTH score of the patient was 7, with an abnormal coagulation index, which can be diagnosed with DIC). It was the first case we experienced clinically and we reported it in this paper. The patient was treated with anticoagulation, blood transfusion, and human albumin. Twenty-eight hours after the operation, she had a second blood test and was then transferred to the intensive care unit (ICU) for further treatment. Blood tests and DIC tests were re-examined 39 hours after surgery. It showed that the patient's anemia situation was relived and the vital signs were stable. She was transferred to the general ward for continued anti-infection and liver protection treatment. Day 5 and 6 after surgery, the swelling of the wound further subsided, without any bleeding, see **Figure 5**

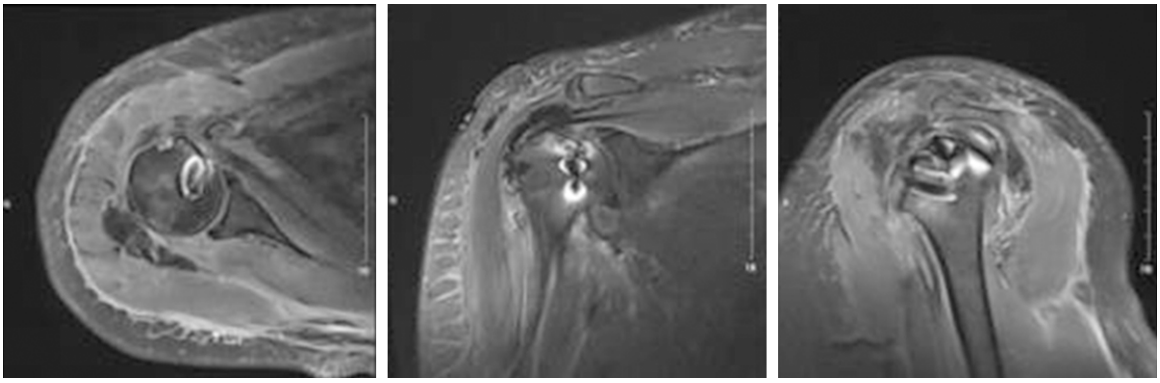

Figure 4. Postoperative MRI of the right shoulder. The supraspinatus and subscapularis tendons are complete and continuous without any retraction. The distance of acromion-humeral head is normal.

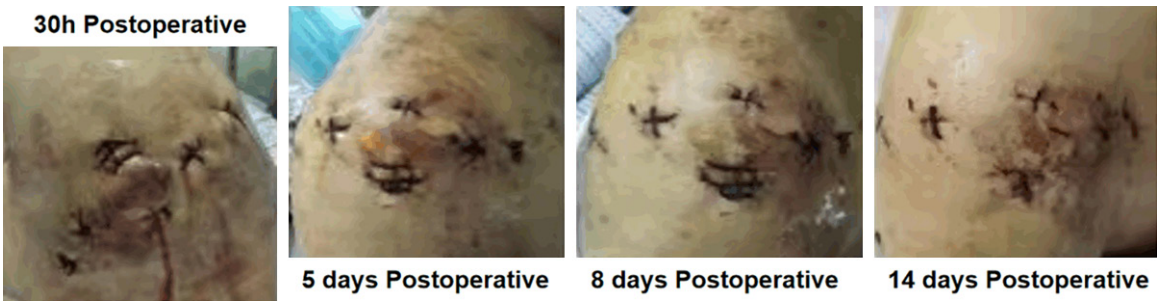

Figure 5. The appearance of the would after surgery. There is a decreasing volume of bleeding from the wound and the swelling is getting lighter.

(**Figure 5**: The appearance of the would after surgery. There was a decreasing volume of bleeding from the wound and the swelling was getting lighter). The amount of hemoglobin and the platelet index were improved, and D-dimer and fibrin degradation products (FDP) significantly decreased compared with previous results, see **Figures 6** and **7** (**Figure 6**: The results of blood analysis. The blood analysis was getting better as the results showed. RBC: Red blood cells (×10^12/L); HGB: Hemoglobin volume (g/L); PLT: Platelet count (×10^9/L); WBC: White blood cells (×10^9/L); NEU%: Percentage of neutrophils; Pre-op: Preoperative; AS: After surgery. **Figure 7**: Postoperative results of DIC. The coagulation index returned to normal level from the fifth day after surgery. PT: Prothrombin time (seconds); PT-INR: International standardized ratio of prothrombin time; APTT: Activated partial thromboplastin time (seconds); FIB-C: plasma fibrinogen (g/L); TT: Coagulation Enzyme time (seconds); ATIII: Antithrombin III test test (%); FDP: Fibrinogen degradation product (ug/ml); DDi: D-dimer (mg/L)). Twelve to 20 days after surgery, the wound healed and the patient's condition was stable, she was then discharged at 20 days after the surgery.

Discussion and conclusion

According to the ISTH, DIC is a secondary syndrome characterized by intravascular coagulation caused by local damage in different situations; it can be caused by damaging the microvascular system, with an acquired systemic thrombotic-hemorrhagic syndrome characterized by secondary fibrinolysis [14, 15]. It is characterized by systematic activation of the coagulation pathway, which can lead to multiple organ system failures in severe cases, with a mortality rate of 25.2% to 76% [16, 17]. Saito et al [18] published a hospital mortality rate of 38% for a DIC multicenter study in Japan. DIC was not an independent disease, but a pathological process secondary to severe diseases, such as severe infectious diseases, malignant tumors, pathological obstetrics, major surgery, and severe trauma, etc [19, 20]. Although the mechanism of DIC varies from disease to dis-

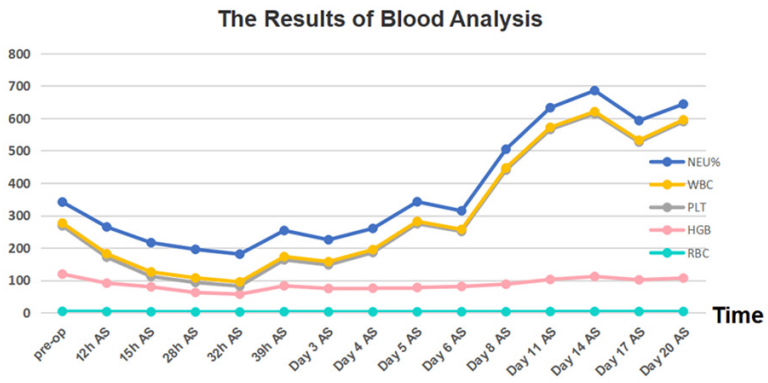

Figure 6. The results of blood analysis. The blood analysis is getting better as the result showed. RBC: Red blood cells (×10^12/L); HGB: Hemoglobin volume (g/L); PLT: Platelet count (×10^9/L); WBC: White blood cells (×10^9/L); NEU%: Percentage of neutrophils; Pre-op: Preoperative; AS:After surgery.

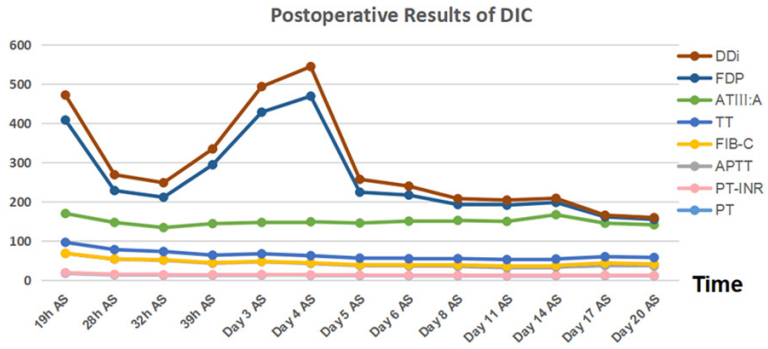

Figure 7. Postoperative results of DIC. The coagulation index returned to normal level from the fifth day after surgery. PT: Prothrombin time (seconds); PT-INR: International standardized ratio of prothrombin time; APTT: Activated partial thromboplastin time (seconds); FIB-C: plasma fibrinogen (g/L); TT: Coagulation Enzyme time (seconds); ATIII: Antithrombin III test test (%); FDP: Fibrinogen degradation product (ug/ml); DDi: D-dimer (mg/L).

ease, it exists as a common process in all cases. It is characterized by the excessive production of thrombus, leading to the production and deposition of fibrin. Besides, fibrinolytic activation and excessive consumption of anticoagulant factors can cause systemic bleeding [21, 22].

Inhibiting coagulation activation is an effective option to limit the burden of diffuse intravascular thrombosis, reduce coagulation factors and platelet consumption, and ultimately prevent major bleeding [23]. Various pathogenic factors, especially those associated with the inflammatory response syndrome, often cause varying degrees of coagulation system activation. When the role of procoagulant factors exceeds the body's compensation mechanism, DIC may occur [24]. DIC has the characteristics of rapid onset, complicated conditions, rapid development, difficult diagnosis, and dangerous prognosis. If not identified and processed in time, it often endangers the lives of patients. Its clinical manifestations vary widely depending on the underlying disease of the patient, the most common thing is organ dysfunction and shock caused by bleeding and thrombosis [23].

DIC not only promotes organ dysfunction but also affects the prognosis of patients. Early diagnosis and early treatment are particularly important. The diagnostic criteria of DIC are traditional coagulation items such as prothrombin time (PT), fibrinogen (FIB), and FDP/D-dimer, platelet count (PLT), etc [25]. Recent studies have clarified the differences in the characteristics of DIC, which always depend on the underlying diseases. For example, sepsis-related DIC is often complicated by organ dysfunction, while blood malignant tumor-related DIC is mainly caused by blood issues. Due to the differences in the mechanism, DIC is divided into thrombus sexual and fibrinolytic phenotypes [26].

Shoulder arthroscopy is a minimally invasive surgery with the advantages of less trauma, less bleeding, and faster recovery [27]. Studies have reported that the complications of shoulder arthroscopic surgery of septic arthritis [28], postoperative fatal pulmonary embolism [29], mediastinal emphysema [30], and carotid sinus hypersensitivity are caused by shoulder strap pressure [31].

The preoperative examination of this patient had a fibrinogen level of 1.04 g/L. Biochemically, the hepatic function was mildly abnormal, and C-reactive protein was 15.4 mg/L. The

other examinations showed no obvious abnormalities, and there was no family history of hereditary coagulopathy. During the operation, we saw bleeding from the subacromial and synovial tissue, and the field of vision was blurred. The patient suffered from major hemorrhage with diffuse intravascular coagulation after surgery. The causes might be as follows: the prolonged high perfusion pressure in the joint may cause vascular endothelial damage, which will induce the activation of the systemic coagulation system and lead to the dysfunction of physiological hemostasis, anticoagulation and fibrinolysis system; the patient's preoperative fibrinogen was only 1.04 g/L, as well, the loss of blood during the operation, and the consumption after the activation of the coagulation mechanism led to the absolute value of fibrinogen being too low, the lack of coagulation factors, in turn, affected the postoperative wound blood coagulation, caused a large amount of bleeding 12 hours after surgery. Fibrinogen is a precursor of fibrin, which is one of the main substrates involved in the process of coagulation and hemostasis. When the blood vessels are damaged, thrombin activation converts fibrinogen into fibrin, and platelets are localized on the wound after activation, it aggregates to form a platelet clot, and forms fibrin polymer by activating factor III and fibrin. Finally, the fibrin polymer stops bleeding by binding to platelet glycoprotein IIb/IIIa receptors to form a stable blood clot. Therefore, fibrinogen is a key factor in maintaining normal coagulation and promoting platelet aggregation to form a stable blood clot [32].

This patient was in the middle stage of DIC and the clinical manifestations were characterized by repeated acute bleeding in the wound. The laboratory tests were characterized by a large and progressive decrease in hemoglobin and platelets, a sharp rise in D-dimer and fibrinogen degradation products, a huge decline in fibrinogen, a sudden prolongation of clotting time, and a positive protamine paracoagulation test.

As recommended, the principle of treatment for diffuse intravascular coagulation is anticoagulation combined with replacement therapy. Microthrombus is still forming during this period, so anticoagulation therapy is essential. Due to the progressive consumption and loss of clotting factors, treatment should be based on anticoagulation, replacement therapy of platelets. As the coagulation factors have been constantly consumed, the supplement of fresh whole blood, fresh plasma, fibrinogen, platelets, and prothrombin complexes are necessary. In the treatment of this case, due to the blood loss, the wound was treated with dressing and pressure dressing to control bleeding as much as possible, and the red blood suspension cells, human albumins, fresh frozen plasma, platelets, and human fiber blood products such as proteinogenic and cryoprecipitate. These treatments not only help to supply clotting factors, fibrinogen and platelets to promote hemostasis, but also promote blood volume, prevent shock, and improve microcirculation. In this case, a total of 2000IU low molecular weight heparin was also used to prevent postoperative thrombosis.

The operation time was over 3 hours, and this puts the shoulder joint in a state of saline high-pressure perfusion for a long time, which might induce vascular endothelial damage, postoperative hemorrhage, and diffuse intravascular coagulation. This cannot be ignored clinically. For preoperative patients with abnormal blood coagulation function, the amount of blood loss during surgery is high, and it is recommended to supply the fibrinogen to a normal value before surgery. For patients who have experienced repeated bleeding after surgery, the examination of DIC should be routine to achieve early detection and early treatment, so that the chance of successful rescue is greater. Once diffuse intravascular coagulation is found after surgery, the vital signs, blood analysis, DIC examination, biochemical and other indicators should be monitored. Besides, the blood coagulation function and thrombus risk should be evaluated to help build a better treatment of the DIC situation. The treatment should involve adequate red blood cell suspension, human albumin, fresh frozen plasma, human fibrinogen, platelets, and other blood products for replacement therapy, so that it is possible to stabilize vital signs and restore the patient's coagulation function, to achieve the purpose of postoperative recovery.

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Medicine approved the ethic and sponsored the study. The patient signed the informed consent for the publication of his clinical details and clinical images. Support for this study was provided by Innovation and Qiangyuan Grant of the First Affiliated Hospital of Guangzhou University of Chinese Medicine (No. 2019Q-N12) and Project of Administration of Chinese Medicine of Guangdong Province of China (No. 20201112) to Youqiang Sun. All authors read and approved the final manuscript.

Disclosure of conflict of interest

None.

Abbreviations

RCT, Rotator Cuff Tear; DIC, Disseminated Intravascular Coagulation; MRI, Magnetic Resonance Imaging; ECG, Electrocardiography; ICU, Intensive Care Unit; FDP, Fibrin Degradation Products; PT, Prothrombin Time; FIB, Fibrinogen; PLT, Platelet Count; ISTH, International Society of Thrombosis and Hemostasis.

Address correspondence to: Dr. Xiaobing Xiang, Department of The Sports Medicine, The First Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangzhou 510405, Guangdong, P. R. China. Tel: +86-13826167426, ORCID: 0000-0001-8935-5374; Fax: +86-020-36591744; E-mail: smcknot@163.com

References

[1] Cole BJ, Cotter EJ, Wang KC and Davey A. Patient understanding, expectations, and satisfaction regarding rotator cuff injuries and surgical management. Arthroscopy 2017; 33: 1603-1606.

[2] Minkalis AL, Vining RD, Long CR, Hawk C and de Luca K. A systematic review of thrust manipulation for non-surgical shoulder conditions. Chiropr Man Therap 2017; 25: 1.

[3] Galatz LM, Ball CM, Teefey SA, Middleton WD and Yamaguchi K. The outcome and repair integrity of completely arthroscopically repaired large and massive rotator cuff tears. J Bone Joint Surg Am 2004; 86: 219-224.

[4] Mirzayan R, Weber AE, Petrigliano FA and Chahla J. Rationale for biologic augmentation of rotator cuff repairs. J Am Acad Orthop Surg 2019; 27: 468-478.

[5] Thon SG, O'Malley L 2nd, O'Brien MJ and Savoie FH 3rd. Evaluation of healing rates and safety with a bioinductive collagen patch for large and massive rotator cuff tears: 2-year safety and clinical outcomes. Am J Sports Med 2019; 47: 1901-1908.

[6] Fisk F, Franovic S, Tramer JS, Gulledge C, Kuhlmann NA, Chen C, Moutzouros V, Muh S and Makhni EC. PROMIS CAT forms demonstrate responsiveness in patients following arthroscopic rotator cuff repair across numerous health domains. J Shoulder Elbow Surg 2019; 28: 2427-2432.

[7] van der Meijden OA, Westgard P, Chandler Z, Gaskill TR, Kokmeyer D and Millett PJ. Rehabilitation after arthroscopic rotator cuff repair: current concepts review and evidence-based guidelines. Int J Sports Phys Ther 2012; 7: 197-218.

[8] Small N. Complications in arthroscopy: the knee and other joints. Committee on complications of the arthroscopy association of north america. Arthroscopy 1986; 2: 253-258.

[9] Marecek GS and Saltzman MD. Complications in shoulder arthroscopy. Orthopedics 2010; 33: 492-497.

[10] Hill JR, McKnight B, Pannell WC, Heckmann N, Sivasundaram L, Mostofi A, Omid R and Rick Hatch GF 3rd. Risk factors for 30-day readmission following shoulder arthroscopy. Arthroscopy 2017; 33: 55-61.

[11] Wu HD, Song ZK, Cao HY, Xu XY, Tang ML, Yang S, Liu Y and Qin L. Successful treatment of amniotic fluid embolism complicated by disseminated intravascular coagulation with rivaroxaban: a case report. Medicine (Baltimore) 2020; 99: e18951.

[12] Kim JS, Ryu JS, Jeon SH, Kim HJ, Nam HS, Cho JH, Kwak SM and Lee HL. Dramatic response of acute disseminated intravascular coagulation to erlotinib in a patient with lung adenocarcinoma with activating EGFR mutation. J Int Med Res 2018; 46: 533-537.

[13] Iba T, Levy JH, Raj A and Warkentin TE. Advance in the management of sepsis-induced coagulopathy and disseminated intravascular coagulation. J Clin Med 2019; 8: 728.

[14] Asakura H, Takahashi H, Uchiyama T, Eguchi Y, Okamoto K, Kawasugi K, Madoiwa S and Wada H; DIC subcommittee of the Japanese Society on Thrombosis and Hemostasis. Proposal for new diagnostic criteria for DIC from the Japanese society on thrombosis and hemostasis. Thromb J 2016; 14: 42.

[15] Iba T, Levi M and Levy JH. Sepsis-induced coagulopathy and disseminated intravascular coagulation. Semin Thromb Hemost 2020; 46: 89-95.

[16] Kawano N, Wada H, Uchiyama T, Kawasugi K, Madoiwa S, Takezako N, Suzuki K, Seki Y, Ikezoe T, Hattori T and Okamoto K. Analysis of the association between resolution of dissemi-

nated intravascular coagulation (DIC) and treatment outcomes in post-marketing surveillance of thrombomodulin alpha for DIC with infectious disease and with hematological malignancy by organ failure. Thromb J 2020; 18: 2.

[17] You DZ, Kendal JK, Duffy P, Monument MJ and Schneider PS. Acute disseminated intravascular coagulation after prophylactic nailing of the femur in a patient with metastatic prostate cancer: a case report. JBJS Case Connect 2020; 10: e0370.

[18] Saito S, Uchino S, Hayakawa M, Yamakawa K, Kudo D, Iizuka Y, Sanui M, Takimoto K, Mayumi T and Sasabuchi Y; Japan Septic Disseminated Intravascular Coagulation (JSEPTIC DIC) study group. Epidemiology of disseminated intravascular coagulation in sepsis and validation of scoring systems. J Crit Care 2019; 50: 23-30.

[19] Senoo S, Mannami T, Tamura T, Fujiwara N, Ikeda G, Komoda M, Ohtawa Y, Fujimoto Y, Sato N, Kambara T, Waku T, Kenmotsu M, Kurimoto E, Okada T, Harita S and Sonobe H. HER2-positive advanced gastric cancer with disseminated intravascular coagulation and diffuse bone marrow carcinomatosis successfully treated with S-1/trastuzumab chemotherapy--a case report. Gan To Kagaku Ryoho 2015; 42: 2471-2475.

[20] Sohal S, Thakur A, Zia A, Sous M and Trelles D. Disseminated intravascular coagulation and malignancy: a case report and literature review. Case Rep Oncol Med 2020; 2020: 9147105.

[21] Ikezoe T. Thrombomodulin/activated protein C system in septic disseminated intravascular coagulation. J Intensive Care 2015; 3: 1.

[22] Gando S, Levi M and Toh CH. Disseminated intravascular coagulation. Nat Rev Dis Primers 2016; 2: 16037.

[23] Lippi G, Langer F and Favaloro EJ. Direct oral anticoagulants for disseminated intravascular coagulation: an alliterative wordplay or potentially valuable therapeutic interventions? Semin Thromb Hemost 2020; 46: 457-464.

[24] Levi M. Pathogenesis and diagnosis of disseminated intravascular coagulation. Int J Lab Hematol 2018; 40 Suppl 1: 15-20.

[25] Luo L, Wu Y, Niu T, Han Y, Feng Y, Ding Q, Huang R, Zhang X, Feng J, Hou M, Peng J, Li Y, Zhou Y, Su L, Yang L, Zhou Z, Xue F, Gu J, Zhu T, Wang X, Deng J, Mei H and Hu Y. A multicenter, prospective evaluation of the Chinese society of thrombosis and hemostasis scoring system for disseminated intravascular coagulation. Thromb Res 2019; 173: 131-140.

[26] Iba T, Umemura Y, Watanabe E, Wada T, Hayashida K and Kushimoto S; Japanese Surviving Sepsis Campaign Guideline Working Group for disseminated intravascular coagulation. Diagnosis of sepsis-induced disseminated intravascular coagulation and coagulopathy. Acute Med Surg 2019; 6: 223-232.

[27] Vier BR, Mombell KW, Gagliano EL, King NM and McDonald LS. Extravasation of fluid in arthroscopic shoulder surgery requiring prolonged intubation: a case report. Patient Saf Surg 2019; 13: 21.

[28] D'Angelo GL and Ogilvie-Harris DJ. Septic arthritis following arthroscopy, with cost/benefit analysis of antibiotic prophylaxis. Arthroscopy 1988; 4: 10-14.

[29] Durant TJ, Cote MP, Arciero RA and Mazzocca AD. Fatal pulmonary embolism after arthroscopic rotator cuff repair: a case series. Muscles Ligaments Tendons J 2014; 4: 232-237.

[30] Kim HK, Ko ES, Kim JY, Park JM, Kim JY and Woo NS. Pneumomediastinum after arthroscopic shoulder surgery -a case report. Korean J Anesthesiol 2013; 64: 376-379.

[31] Canbora MK, Polat A, Subasi FD and Ulku TK. Carotid sinus hypersensitivity due to shoulder sling pressure after arthroscopic rotator cuff repair: a case report. Acta Orthop Traumatol Turc 2012; 46: 308-311.

[32] Weisel JW, Nagaswami C, Vilaire G and Bennett JS. Examination of the platelet membrane glycoprotein IIb-IIIa complex and its interaction with fibrinogen and other ligands by electron microscopy. J Biol Chem 1992; 267: 16637-16643.