JOINTS 2025; 3: e1413

Category: Case Report

TRAUMATIC POSTERIOR DISLOCATION OF THE STERNOCLAVICULAR JOINT IN A PROFESSIONAL BASKETBALL PLAYER: SYSTEMATIC REVIEW AND CASE REPORT

L. SIRACUSANO, V. ADDORISIO, B. FAZIO, S. CALACIURA, D. FENGA, I. SANZARELLO, E. CALAMONERI, D. LEONETTI

• • •

Department of Biomedical, Dental and Morphological and Functional Images, Section of Orthopedic and Traumatology, University of Messina, Via Consolare Valeria 1, Messina, Italy

CORRESPONDING AUTHOR
Ilaria Sanzarello, MD; e-mail: ilaria.sanzarello@unime.it

ABSTRACT – *Objective:* Posterior dislocation of the sternoclavicular joint (SCJ) is a rare occurrence but can be associated with life-threatening injuries. Standard guidelines regarding its treatment have not been defined.

Case Report: A 23-year-old professional basketball player presented with a posterior dislocation of the SCJ. He underwent open reduction, direct anterior and dorsal ligament repair, and capsule repair and augmentation using fiber tape. Three months after his injury, he returned to play professionally.

Materials and Methods: A thorough systematic review of the English literature was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in the following databases: PubMed, Cochrane, and EMBASE, to identify all cases of acute posterior SCJ dislocations to focus on the repercussions of different surgical techniques on shoulder girdle biomechanics. Eventually, 51 patients were detected from 9 studies.

Results: Posterior dislocations mainly occur during sports activities, especially football, due to a direct impact on the thorax or an indirect force posterolateral to the shoulder. Thirty-nine patients underwent open reduction (76.47%), and the remaining subjects were managed with closed reduction (23.53%). Many surgical techniques were described, all with good clinical outcomes. No intra-operative and post-operative complications were reported.

Conclusions: Both closed and open reduction have proven highly effective for treating posterior SCJ dislocation. However, available data is not sufficient to define which surgical procedure is most effective for restoring shoulder biomechanics.

KEYWORDS: Sternoclavicular joint, Sternoclavicular posterior dislocation, Acute posterior dislocation, Posterior sternoclavicular dislocation treatment.

INTRODUCTION

The sternoclavicular joint is a diarthrodial saddle-type synovial joint that is intrinsically unstable, as only about 40% of the medial clavicular surface articulates with its corresponding articular surface on the manubrium. Therefore, the stability of this joint relies on its ligaments and articular capsule. These

structures include the rhomboid or costoclavicular ligament, in which we recognized an anterior fasciculus that resists superior rotation and lateral displacement and a posterior fasciculus opposing inferior rotation and medial displacement. The interclavicular ligament, the posterior and anterior sternoclavicular ligaments also improve sternoclavicular joint (SCJ) stability. Posterior structures are more resistant than anterior ones, explaining why posterior dislocation is less common than anterior[1]. SCJ dislocations are uncommon, accounting for 1% of all dislocations. Posterior dislocations are even rarer, representing 5% of SCJ dislocations. Because of their proximity to the superior mediastinum, posterior dislocations may have life-threatening complications. However, the reported rate of neurovascular injuries in the literature is poor[2].

They might be the result of direct trauma due to a posteriorly directed force applied to the medial clavicle, such as in the case of motor vehicle accidents or sports injuries. On the other hand, more frequently, an indirect force posterolateral to the shoulder pushes the lateral clavicle anteriorly and levers the medial clavicle posteriorly[3,4]. Patients with posterior SCJ dislocation usually present with functional limitation of the affected shoulder and severe pain. There might be a subtle asymmetry of the shoulder girdle and a minor sternoclavicular prominence, but these signs may not be visible or palpable in case of severe swelling. Due to the possible involvement of mediastinal structures, dyspnea, dysphagia, dysphonia or neurovascular symptoms may occur[5]. Early diagnosis might be difficult, with standard X-rays and computed tomography (CT) often required to diagnose and evaluate complications. Due to its rarity and the scarcity of the literature, there is no consensus on how to manage acute and chronic dislocations. Therefore, individual cases published in the existing literature can contribute to the training of surgeons who are first approached with this condition. Surgical treatment should be considered when closed reduction is not feasible and in cases of mediastinal injury requiring urgent intervention[2].

We present a case of a young professional basketball player with posterior SCJ dislocation treated surgically. This study aims to 1) present our experience on a case of posterior SCJ dislocation and 2) systematically review the current literature about acute posterior SCJ dislocation treatment, focusing on the repercussions of different surgical methods on shoulder girdle biomechanics and final outcomes.

CASE PRESENTATION

A 23-year-old male professional basketball player was tackled during a basketball game by a player of the opposite team who directly struck his right shoulder. His vital signs on admission were as follows: Glasgow Coma Scale, 15; heart rate, 68 beats/min; blood pressure, 130/85 mmHg; respiratory rate, 17 breaths/min; 98% oxygen saturation on room air. Upon presentation, there was functional impairment of the right shoulder accompanied by severe pain during attempts at mobilization. There was a palpable mild depression in the anterior right-side thoracic region, and the patient reported mild dysphagia and dysphonia without dyspnea or any neurovascular signs. His radial pulses were symmetric. Posteroanterior chest and anteroposterior shoulder radiographs were performed. There was an asymmetry between the sternoclavicular joints but no evident dislocation on plain radiographs (Figure 1). As the cause of symptoms was not clear, a contrast-enhanced computed tomography (CT) was performed, which revealed a posterior sternoclavicular dislocation of the right SCJ with a 14 mm displacement. No injury of the mediastinal structures was revealed, only a slight compression of the trachea and esophagus, which explained the patient's symptoms upon his arrival at the emergency department (Figures 2 and 3). As the patient was stable, he was non-emergently taken to the operating room 7 hours later to attempt a closed reduction procedure in narcosis. Hence, a bolster was placed under his scapulae, and, with the shoulder in 90° abduction, lateral traction was applied while slowly extending the shoulder. As the first attempt was not resolutive, a second one was carried out using a sterile towel clip. The dislocation was not managed. Therefore, we decided to perform an open reduction.

Surgical Technique

The patient was placed in a supine position, with a bolster under his scapulae, under general anesthesia. Throughout the whole procedure, a vascular surgeon was prepared for any assistance. Obviously, our choice was for a traditional dorsal approach for good visualization but also for a reduction in the risk of iatrogenic damage. A 5 cm incision was centered on the medial aspect of

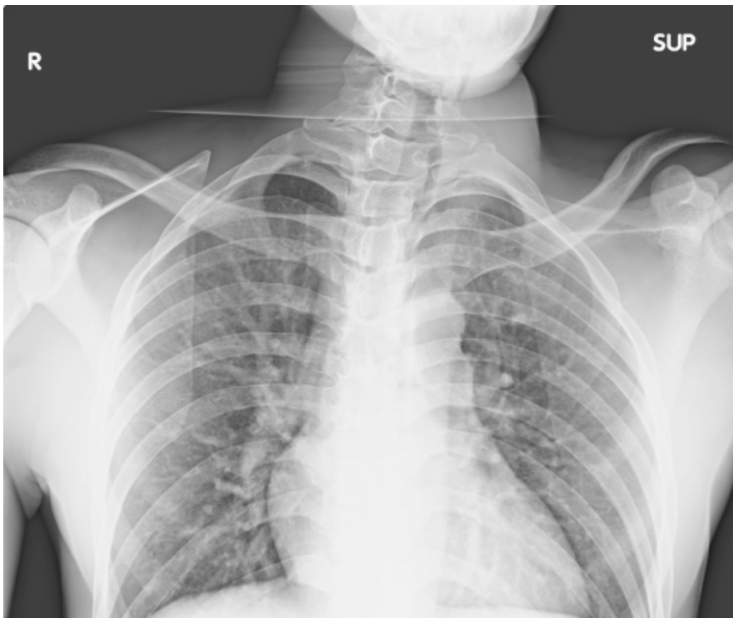

Figure 1. Chest radiograph showing an asymmetry of the sternoclavicular joints.

the clavicle and extended medially to the sternum. The platysma muscle was incised, the anterior capsule was reached, and the underlying SC joint was exposed. A complete disruption of the SCJ was noted: the anterior and dorsal sternoclavicular ligaments were lesioned and detached from the medial aspect of the clavicle. The intra-articular disc was ruptured. The SCJ was reduced with a gentle maneuver using proper forceps with the shoulder in 90° abduction, lateral traction was applied while slowly extending the shoulder. Afterward, the disc and the anterior capsule were repaired through a direct side-to-side suture; anterior and dorsal ligaments were reinserted on the clavicular aspect of the joint using a suture anchor. Subsequently, the joint was further stabilized through a ligament augmentation technique with fiber tape using two swive-lock anchors (Arthrex, Inc., Naples, FL, USA) (Figures 4 and 5). Throughout the procedure, the image intensifier was used. Joint congruence and stability were tested.

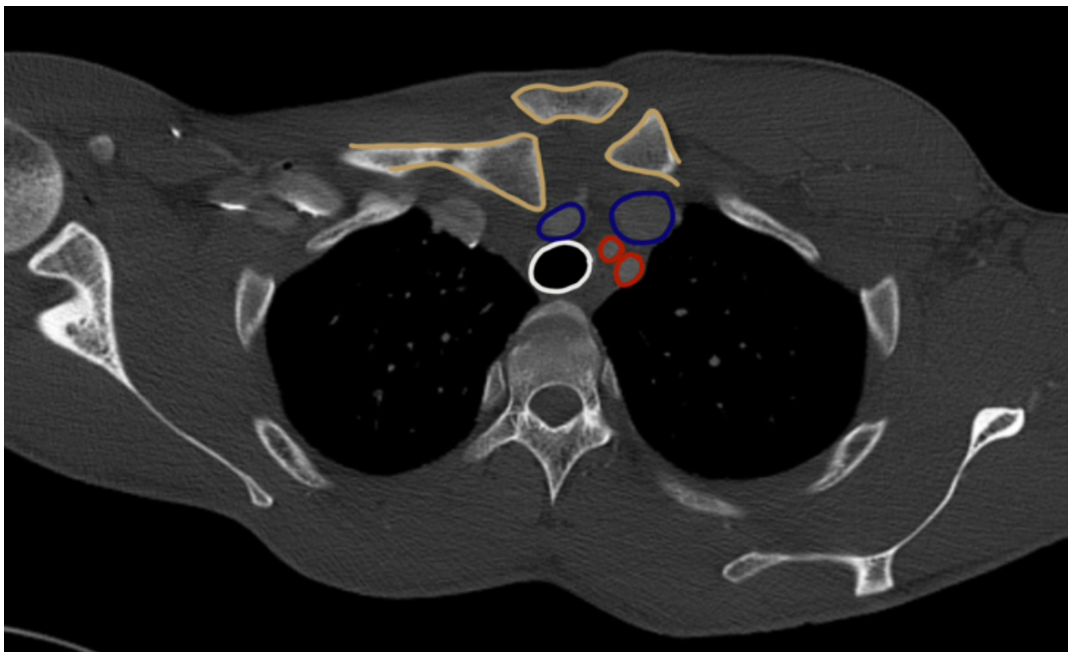

Figure 2. CT scan showing a posterior dislocation of the right medial clavicular head in relation to the sternum and partial compression of mediastinal structures. In red: subclavian and common carotid arteries; in yellow: sternoclavicular joint; in blue: brachiocephalic vein (big circle) and trachea (small circle); in white: esophagus.

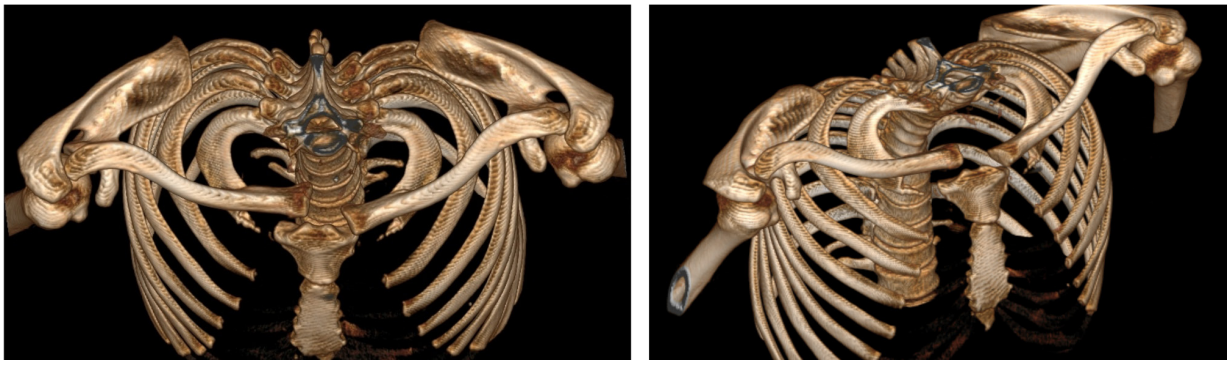

Figure 3. Three-dimensional chest reconstructed computed tomography after trauma.

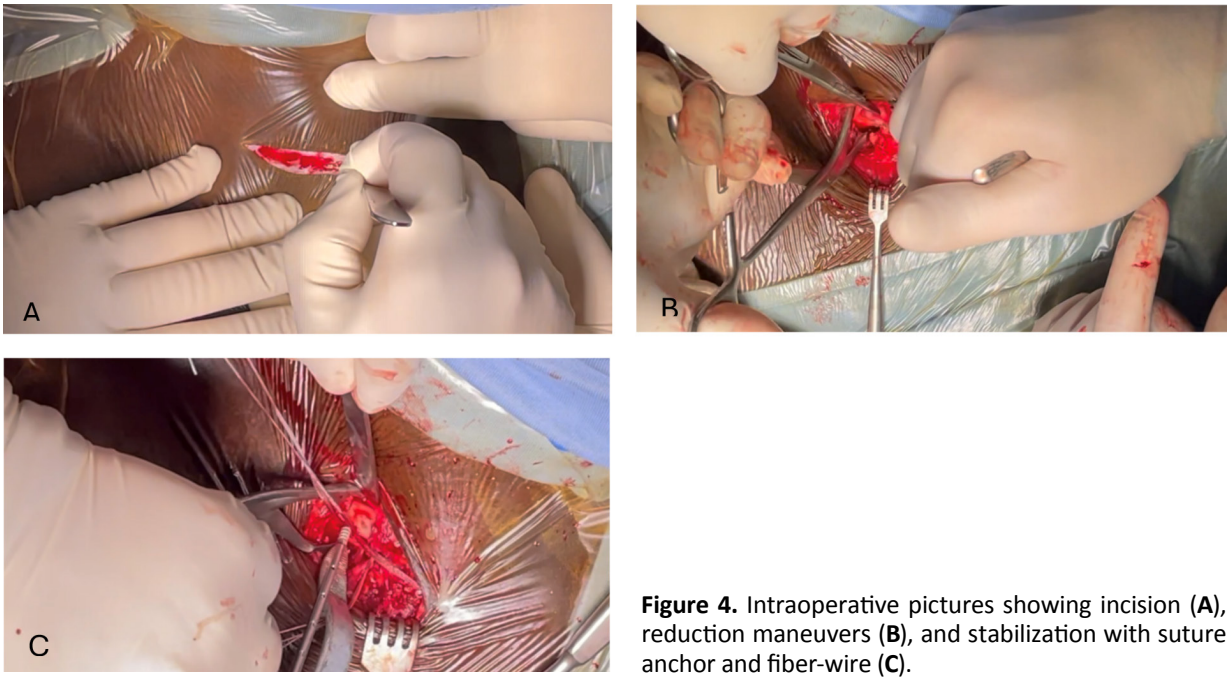

Figure 4. Intraoperative pictures showing incision (**A**), reduction maneuvers (**B**), and stabilization with suture anchor and fiber-wire (**C**).

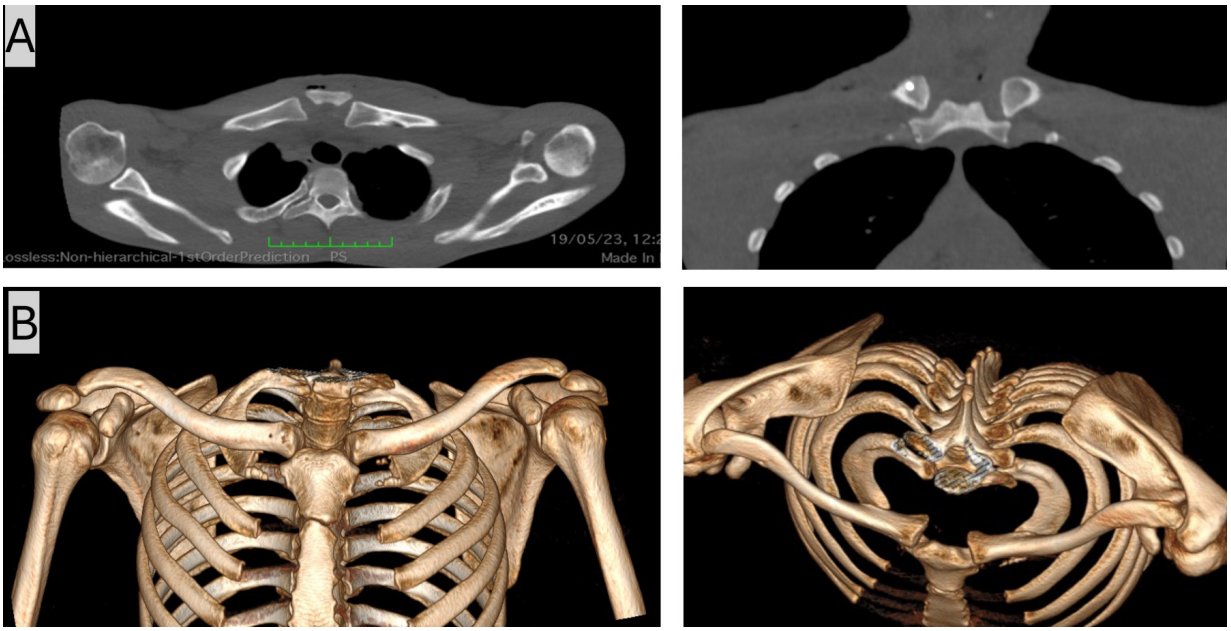

Figure 5. Post operative CT-scan: axial and coronal views (**A**); 3D-reconstruction (**B**).

Post-Operative Course

After surgery, there was a complete resolution of mediastinal symptoms. No intra-operative and post-operative complications were reported, and post-operative pain was accurately controlled. The patient was discharged from our hospital a week after admission, with his right arm kept in a sling for four weeks. Two weeks after surgery, he started cautious passive and active shoulder motion assisted by a physiotherapist. At 1-month post-surgery, the patient reported mild pain and limitation on end-of-range motions. He recovered 170° shoulder elevation and 170° abduction. Three months after surgery, he presented a Rockwood sternoclavicular joint score of 13 and a Constant-Murley score of 86/100, questionnaires evaluating pain, range of motion (ROM), strength, limitations, and the ability to carry out the normal daily activities of the patient. The patient autonomously returned to play professionally. At the 1-year follow-up, recovery was excellent, with a Rockwood score of 14 and a Constant-Murley score of 96/100; he keeps playing basketball without any deficiency, pain, or limitations.

MATERIALS AND METHODS

Search Strategy

We conducted a systematic review to summarize the current knowledge on acute posterior sternoclavicular dislocation and its treatment in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[6]. An extensive search was performed in the following databases: PubMed, Cochrane and EMBASE. To address the research questions, we used the following terms: posterior sternoclavicular joint AND dislocation (OR injuries), AND treatment, OR acute. Following the recognition of potential articles, an initial screening of titles and abstracts was performed. Subsequently, relevant full-text articles were retrieved and independently assessed for eligibility by three of the authors (L.S., V.A., B.F.). Disagreements regarding the inclusion of an article were solved by a third reviewer (E.C.), who agreed upon the final list of included articles. The same authors also assessed the level of evidence of each clinical report.

Inclusion and Exclusion Criteria

We collected data only from English-written observational studies and case series discussing acute posterior SCJ dislocation in patients who were 16 years of age or above, its treatment techniques, and its long-term effects on daily and, when specified, on sports activities. We excluded any study involving specifically chronic SCJ dislocation, superior or anterior dislocation, fracture-dislocation, growth-plate fracture, and atraumatic or congenital conditions. However, when possible, the extraction of selective data was performed in those studies addressing both acute posterior and chronic posterior or anterior dislocations. Moreover, articles that did not address treatments or clinical outcomes of SC joint dislocations were excluded.

Data Extraction

The following parameters were extracted and analyzed: number of patients, patient demographics (age, sex), type of procedure (closed or open reduction), follow-up, CT-scan pre and post-operatively, type and number of intra- and postoperative complications, physiotherapeutic protocol, return to daily and, when applicable, to sports activities.

Our results, using the above-mentioned databases according to the PRISMA guidelines, resulted in 273 articles. After reviewing, 9 full-text articles meeting the inclusion criteria were included in our review (Figure 6), 5 of which have a Level IV of evidence (case series)[7-11] and 4 of them a Level III of evidence (observational studies)[12-15] (Tables 1 and 2).

Quality Assessment

The quality of the included studies was assessed by three reviewers (L.S., V.A., B.F.) according to the Methodological Index for Non-Randomized Studies (MINORS) score[16]. MINORS contains 12

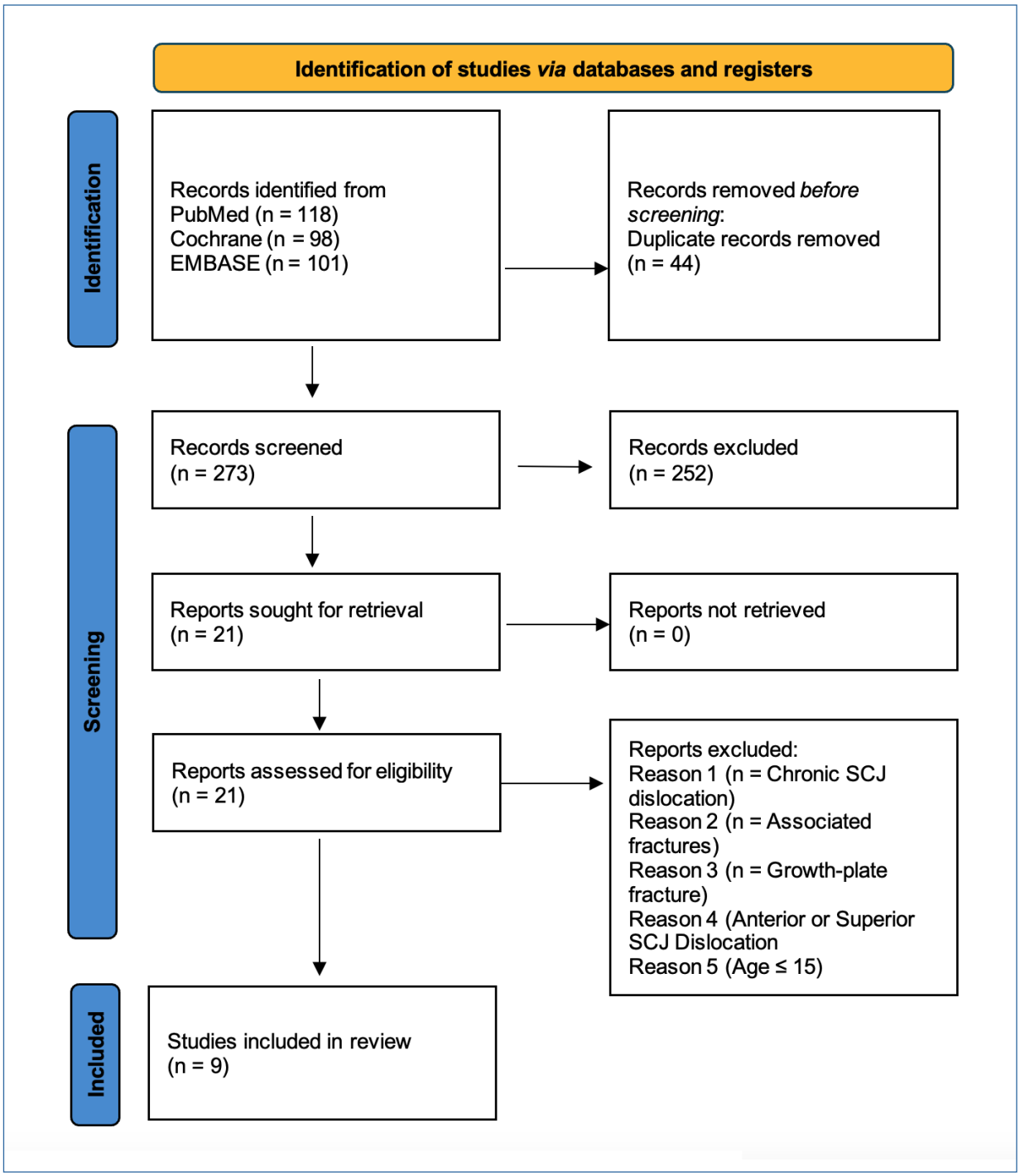

Figure 6. PRISMA Flow chart of the literature review.

items, with the first 8 items specifically for non-comparative studies. Each item is scored from 0 to 2, with 0 indicating that the item was not reported, 1 indicating it was reported but inadequately, and 2 indicating it was reported and adequately. The maximum score for non-comparative studies is 16, and for comparative studies is 24. The 12 items in MINORS are (1) a clearly stated aim, (2) inclusion of consecutive patients, (3) prospective collection of data, (4) endpoints appropriate to the aim of the study, (5) unbiased assessment of the study endpoint, (6) follow-up period appropriate to the aim of the study, (7) loss to follow up less than 5%, and (8) prospective calculation of study size. For comparative studies, MINORS includes 4 additional items: (9) an adequate control group, (10) contemporary groups, (11) baseline equivalence of groups, and (12)

adequate statistical analyses. The reliability of MINORS was established through good inter-reviewer agreement, high test-retest reliability, and good internal consistency. Its external validity was demonstrated by its ability to identify high-quality studies compared to the CONSORT statement for randomized trials[16] (Table 1).

RESULTS

Using the above-mentioned databases and keywords, our search produced 273 results. We selected 9 full-text articles meeting the inclusion criteria: 5 case series[7-11] and 4 observational studies[12-15], for a total of 51 patients with a mean MINOR score of 7.8. The mean age at the time of the injury was 32.25, and the male/female ratio was 34:4 (89.19% male patients), although these data were not specified in two studies[7,8]. Mechanism of injury was specified in 6 articles[3-8] (80.4% of patients): 58.5% of injuries occurred during sports activity, most commonly football, rugby, soccer, or skiing; 22% due to road accidents; 12.2% due to falls; other causes were reported in 2.8% of cases. Mild mediastinal compression symptoms at presentation were observed in 21.56% of cases. No patient was hemodynamically unstable. In the studies analyzed, the average follow-up was 18.6 months (3-128 months). Follow-up was reported heterogeneously, with some studies not reporting the follow-up or reporting a follow-up period not for every single patient but only as an average value (Tables 2 and 3)[14]. Most of the studies did not specify the final ROM at the end of the follow-up period, and some did not use a specific score to evaluate the outcome[7,8,10], as they only confirmed the return to pre-injury status. 6 studies[9,11-15] adopted different scoring systems: the Constant-Murley score, Rockwood score, American Shoulder and Elbow Surgeons (ASES) score, Disabilities of the Arm, Shoulder, and Hand (DASH) score, the simple shoulder test (SST), subjective shoulder value (SSV) score, patient-reported outcome measures (PROM) T-score and the Oxford shoulder score were used. Outcomes were mostly evaluated according to the presence of pain, ROM limitations, instability of the SCJ, or return to play in the case of professional athletes (Table 4). Thirty-nine patients underwent open reduction (76.47%), and the remaining subjects were managed with closed reduction under general anesthesia (23.53%). In two patients, closed reduction was firstly successful; later on, they had to undergo surgery respectively due to recurrence and anterior instability[12]. Plating was performed in 22 patients (56.41%)[7,9,13-15]. In 5 cases (12.82%), tenodesis was performed: 4 patients underwent open reduction and subclavius tendon autograft stabilization, and 1 patient was treated with sternocleidomastoid tendon allograft reconstruction[12]. Suture-repair-only was adopted in 8 patients (20.51%)[9,10,12]: 4 of which were with absorbable sutures and 4 with non-absorbable ones. Stabilization and ligament reconstruction with fiber wires and anchor sutures were reported in 3 cases (7.69%)[11]. The application of K-wires and steel cerclage was described in 3 cases (7.69%). In 2 patients, two stabilization procedures were performed: tenodesis + wiring and plating + non-absorbable suture, respectively[9,12] (Table 5). No intraoperative complications were reported.

Table 1. MINORS Score of included studies.

Authors	Published year	Study design	MINORS
Laffosse et al[12]	2010	RS	10
Hecox and Wood[7]	2010	CS	5
Janson and Rossouw[8]	2013	CS	5
Quispe et al[13]	2015	RS	11
Kirby et al[9]	2015	CS	9
Labronici et al[10]	2016	CS	6
Zhang et al[14]	2017	RS	8
Adamcik et al[11]	2017	CS	8
Xin et al[15]	2023	RS	9

RS: retrospective study; CS: case series.

Table 2. Descriptive characteristics of component studies.

Authors	No. of patients	No. of patients with acute posterior SCJD	Mean age (range)	Male/Female ratio	Follow-up rate (%)	Patients lost to FU	Mean FU time (months) (range)
Laffosse et al[12]	30	15	19 (17-41)	13/2 (76.47%)	73.33%	4	51.81 (14-128)
Hecox and Wood[7]	8	3	n/a	n/a	100%	0	3
Janson and Rossouw[8]	5	2	n/a	n/a	100%	0	12
Quispe et al[13]	3	2	20.5 (18-23)	1/1	100%	0	8
Kirby et al[9]	16	16	30 (16-46)	11/1	75%	4	42 (12-108)
Labronici et al[10]	2	2	27 (18-36)	2/0	100%	0	12
Zhang et al[14]	32	5	42	n/a	100%	0	n/a
Adamcik et al[11]	3	3	23.33 (20-27)	3/0	100%	0	12.33 (10-14)
Xin et al[15]	11	11	54.91 (33-71)	8/3	100%	0	18 (15-24)

FU: Follow-up.

Table 3. Data regarding mechanisms of injury, symptomatology at presentation and closed reduction attempt.

Authors	Mechanism of injury	Mediastinal symptoms	Hemodynamic instability	CT scan pre-operative	CT scan post-operative	Attempt of CR	Failed CR	No. of patients undergoing surgery
Laffosse et al[12]	Contact sports	2	0	11	11	6	2	7
Hecox and Wood[7]	n/a	n/a	0	n/a	0	3	2	2
Janson and Rossouw[8]	n/a	n/a	0	n/a	n/a	0	0	2
Quispe et al[13]	RA/Sport	2	2	0	0	2	2	2
Kirby et al[9]	Sports/RA/Fall	7	0	12	n/a	8	6	6
Labronici et al[10]	Sports	0	0	2	1	2	1	1
Zhang et al[14]	n/a	n/a	0	5	5	n/a	n/a	5
Adamcik et al[11]	Sports	0	0	3	n/a	3	3	3
Xin et al[15]	RA/Fall/other	n/a	0	11	11	0	0	11

CR: closed reduction, RA: road accident.

Table 4. Interventions, complications, physiotherapeutic protocol and outcomes of the included studies.

Authors	Surgical techniques	Intraoperative complications	Post operative complications	Physiotherapic protocol	Return to daily activities	Return to sports	Score evaluation at final FU
Laffosse et al[12]	Tenodesis/wiring/ sutures-only	0	0	Sling for 3 weeks	11	10	DASH 36.47; CMS 91.90; SST 17.8; OSS 12.9
Hecox and Wood[7]	Ledge plating	0	0	Sling for 2 weeks/ figure-of-eight sling for 4 weeks	2	2	n/a
Janson and Rossouw[8]	Figure-of-eight sternal cable system	0	0	n/a	1	1	n/a
Quispe et al[13]	Locking compression plate	0	0	Sling for 2 weeks	2	1	DASH 25; PROMS 45.95
Kirby et al[9]	Plate/suture + buttress plate/suture-only	0	0	n/a	10	10	ASES 96.24; SSV 90.83
Labronici et al[10]	Suture with an eight-	0	0	Sling for 6 weeks	2	n/a	n/a
Zhang et al[14]	Hook plate	0	0	Sling for 2 weeks	5	n/a	n/a
Adamcik et al[11]	Fiberwire	0	0	Gilchrist bandage for 3 weeks	3	3	DASH 25.3
Xin et al[15]	Hook plate	0	0	Sling for 3 weeks	11	n/a	CMS 93.64 ± 9.01; RS 13.36 ± 1.86

FU: Follow-up; DASH: Disability of the Arm, Shoulder and Hand Score; CMS: Costant-Murley Score; SST: Simple Shoulder Test; OSS: Oxford Shoulder Score; PROMS: Patient-Reported Outcome Measures; ASES: Assessment Shoulder and Elbow Scale; SSV: Subjective Shoulder Value; RS: Rockwood Score.

Table 5. Surgical techniques.

Fixation technique	No. of patients (%)
Plating	22 (56.41%)
K-wires/cerclage	3 (7.69%)
Suture-repair-only	8 (20.51%)
Fiber wires	3 (7.69%)
Tenodesis	5 (12.82%)
Total	**39***

*39 patients and 41 procedures as two patients underwent two stabilization techniques.

Post-operatively, patients were placed in a sling or a Gilchrist or a figure-of-eight brace for 2 to 6 weeks. The authors did not justify the use of a brace over another. Regardless of the treatment method, each patient underwent gradual physiotherapy to reduce pain, improve range of motion, and promote shoulder stabilization using isometric training. In many patients, abduction was firstly limited to 90°. Naturally, the rehabilitation program was adapted to the patient's needs. There were no post-operative complications reported. Only a case of re-dislocation and a case of anterior instability, followed by closed reduction, were observed. Removal of the implant usually took place over a period of 3 to 12 months.

Overall, 83.33% and 97.43% of patients treated conservatively and surgically, respectively, had a successful outcome, defined as full pain-free ROM without recurrence. They regained a full range of motion and returned to daily activities within 3 months. 27 patients, including professional and amateur athletes, achieved full return to play. However, return to play was not specified in 3 studies.

DISCUSSION

This study aims to present our experience on a case of posterior SCJ dislocation of a professional basketball player and systematically review the current literature about acute posterior SCJ dislocation.

The sternoclavicular joint is a diarthrodial saddle-type synovial joint that is intrinsically unstable; the stability of this joint relies on its ligaments and articular capsule. Several biomechanical studies[17] have shown that the glenohumeral, acromioclavicular, and sternoclavicular joints work as one kinematic chain, suggesting that abnormal functioning of one of these joints results in a pathological scapulothoracic motion. The sternoclavicular joint allows movement of the clavicle relative to the thorax, mainly in the horizontal and vertical planes, although a rotational component is present. In arm elevation, for every ten degrees of elevation of the arm to 90°, there is approximately 4° of elevation of the clavicle[18,19]. During retraction, a 5° posterior rotation of the clavicle compared to the thorax occurs, whereas protraction leads to an anterior clavicular rotation of 3°. In abduction, the sternoclavicular joint has 35° of range and a 30° of rotation occurs in case of 60° or greater degree of arm abduction[20,21].

The indications for treating posterior SCJ dislocation depend on the patient's symptoms. Closed reduction should be attempted under general anesthesia when the patient is stable. Surgical management should be considered when closed reduction is not feasible and in the presence of mediastinal injury requiring urgent intervention[22]. Some studies[11,12] report cases of unreduced dislocation in which the patient was discharged with no complaints at first but eventually, most of the time, required surgery due to instability related to chronic dislocation. The literature[12,23,24] also reports some cases of recurrent dislocation after closed reduction or open reduction without fixation. Closed reduction can be achieved by placing a bolster between the scapulae, positioning the arm in 90° abduction, and applying lateral traction while slowly extending the shoulder. As an alternative, traction in adduction can be applied on the arm along the axis of the upper limb with direct manipulation of the clavicle medial end. In both reduction maneuvers, a sterile towel clip may be required[25]. Various methods of operative treatment have been described, including resection of the medial clavicle, cannulated screws, plating (T-shaped plate, hook plate, ledge plate, dynamic compression plating (DLP), locking compression plating (LCP), anterior buttress plating), suture anchor fixation, fiber wires in an eight-figure configuration, and tenodesis, mainly with hamstring muscle tendons or subclavius to repair soft tissue tears. In the last decade, fixation with k wires, pins, and metallic cerclage has been abandoned due to the high risk of fatal complications due to migration[26,27].

The case we reported perfectly fits the surgical options found in the current literature, with the same good outcome. We presented a case of a professional basketball player who underwent anterior and dorsal ligament and capsule repair and augmentation using a suture anchor and a fiber wire. He managed to return to play professionally with a pain-free ROM within 3 months. We would like to point out that due to his functional demands, we decided to repair anterior structures only to sufficiently stabilize the joint, thus allowing secondary intention healing of posterior structures without the risk of stiffness or delayed mobilization that might be associated with other surgical techniques. Our choice of treatment is due to the potential for serious intraoperative complications from accessing posterior structures. In addition, because our patient is a professional player, we chose a procedure that would not involve any potential weakening associated with hamstring tenodesis. Moreover, fiber-wire has excellent characteristics in terms of strength and flexibility, which provides an optimal replacement for damaged ligaments, thus avoiding long-term complications such as tendon atrophy and elongation, which may lead to chronic instability.

To date, no studies correlate posterior sternoclavicular dislocation to its biomechanical effects on shoulder biomechanics. Our literature review focused on the relation of different surgical methods on shoulder girdle biomechanics, aiming to compare different techniques with the final outcome. However, due to the small number of patients treated with each technique and the lack of the use of scoring systems, it is difficult to provide comparative data.

We observed that closed reduction was successful in 10 cases out of 26 attempts (38.46%). However, it must be considered that some authors[15] are of the opinion that in the case of posterior dislocation, direct surgery should be performed without an attempt at closed reduction. Others[3], instead, regard closed reduction as a valid solution that should be attempted within a limited period of time from trauma: some[5] do not attempt closed reduction after 24 hours, while others[14] believe closed reduction can be attempted up to 48 hours after injury. Several cases of closed reduction after 72 hours have been reported in literature, although most of the authors agree on a more successful reduction rate within 48 hours from trauma[28-30].

Overall, we recorded good clinical outcomes in 94.11% of patients (83.33% and 97.43% of patients treated conservatively and surgically, respectively). We, therefore, agree that closed reduction should always be attempted in a non-urgent situation, as stated in the literature, and that open reduction can be achieved in cases of persistent instability, also taking into account the functional requirements of the patient[31]. Furthermore, our results are in line with the current literature, as the use of metal wires is gradually decreasing and the choice of performing a soft tissue repair is increasing. In fact, ligament and capsule repair with or without grafting or augmentation was performed in 41.02% of cases[3,5-7]; K-wires and steel cerclage were adopted only in 7.69% of cases[3,16]. On the other hand, plating was the treatment of choice in 56.41% of cases. A successful recovery was achieved regardless of the procedure adopted. Longer recovery with mild pain and stiffness still at 3 months from the surgery were reported respectively in a patient treated with plating[4] and in a case of figure-of-eight cerclage[3]. This data is insufficient to determine which procedure provides the best outcome and biomechanical restoration.

Limitations

Our study presents several limitations. The identified studies were all retrospective studies and case series with levels III and IV of evidence. In addition, the current literature is characterized by heterogeneity of reporting regarding outcome measures and follow-up length. Finally, by excluding case reports, the study does not present different techniques, which introduces a selection bias. These factors strongly influence the interpretation of the results, making further studies, such as controlled clinical trials and shared outcome assessment protocols, necessary to evaluate the potential advantages of suture anchors and fiber wires over the other techniques and to assess the biomechanical implications of each surgical procedure on shoulder mobility.

CONCLUSIONS

Due to the limited number of cases described, the approach towards posterior dislocation of the SCJ needs to be standardized. No prospective randomized clinical trials or comparative studies have been performed on this topic. In our limited experience, anchor sutures and fiber wires could find an indication in posterior SCJ dislocation when closed reduction is not feasible, as they repre-

sent a less invasive and risky surgery that might allow a faster recovery than other procedures, especially in the case of professional athletes. In conclusion, although posterior dislocation of the SCJ is a growing and challenging topic in orthopedic research, standardized guidelines and reproducible research are still missing. Further research with systematically collected data and biomechanical studies is needed to standardize parameters such as scoring systems, follow-up periods, and radiographic criteria to allow direct comparison between different surgical options, to train younger surgeons approaching this surgery, and to provide the scientific basis for cost-benefit analysis.

Conflict of Interest:

The authors declare that they have no conflict of interest to disclose.

Informed Consent:

The patient provided written informed consent to receive therapy and to publish this case report.

Ethics Approval:

Not applicable since data were collected as part of routine care.

Funding:

The study was not supported by any source of funding.

Data Availability:

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

AI Disclosure:

During the preparation of this work, the authors did not use any AI or AI-assisted technologies to improve the scientific work.

Authors' Contributions:

Lorenza Siracusano (MD): collaborated on collecting data and performing the methodological analysis for the present case, and writing the introduction, case presentation and discussion of the present paper.
Vito Addorisio (MD): collaborated on writing the introduction and case presentation of the present paper and collecting data for the present case.
Benedetto Fazio (MD): collaborated on writing the introduction and case presentation of the present paper and collecting data for the present case.
Salvatore Calaciura (MD): collaborated on collecting data for the present case.
Domenico Fenga (MD): collaborated on writing the introduction and case presentation.
Ilaria Sanzarello (MD): collaborated on collecting data for the present case and analysis of imaging.
Emanuele Calamoneri (MD): responsible for surgical treatment.
Leonetti Danilo (MD): responsible for surgical treatment and analysis of imaging and data for the described case, other than validating the final paper.

REFERENCES

1. Spencer EE, Kuhn JE, Huston LJ, Carpenter JE, Hughes RE. Ligamentous restraints to anterior and posterior translation of the sternoclavicular joint. J Shoulder Elbow Surg 2002; 11: 43-47.
2. Sernandez H, Riehl J. Sternoclavicular Joint Dislocation: A Systematic Review and Meta-analysis. J Orthop Trauma 2019; 33: e251-e255.
3. Mehta JC, Sachdev A, Collins JJ. Retrosternal dislocation of the clavicle. Injury 1973; 5: 79-83.
4. Glass ER, Thompson JD, Cole PA, Gause TM 2nd, Altman GT. Treatment of sternoclavicular joint dislocations: a systematic review of 251 dislocations in 24 case series. J Trauma 2011; 70: 1294-1298.
5. Garcia JA, Arguello AM, Momaya AM, Ponce BA. Sternoclavicular Joint Instability: Symptoms, Diagnosis and Management. Orthop Res Rev 2020; 12: 75-87.
6. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021; 372: n71.

7. Hecox SE, Wood GW 2nd. Ledge plating technique for unstable posterior sternoclavicular dislocation. J Orthop Trauma 2010; 24: 255-257.
8. Janson JT, Rossouw GJ. A New Technique for Repair of a Dislocated Sternoclavicular Joint Using a Sternal Tension Cable System. Ann Thorac Surg 2013; 95: e53-e55.
9. Kirby JC, Edwards E, Kamali Moaveni A. Management and functional outcomes following sternoclavicular joint dislocation. Injury 2015; 46: 1906-1913.
10. Labronici PJ, Souza FC, Pires RE, Santos Filho FC, Gameiro VS, Labronici GJ. Posterior dislocation of the sternoclavicular joint: report of two cases. Rev Bras Ortop 2016; 51: 601-605.
11. Adamcik S, Ahler M, Gioutsos K, Schmid RA, Kocher GJ. Repair of sternoclavicular joint dislocations with FiberWire®. Arch Orthop Trauma Surg 2017; 137: 341-345.
12. Laffosse JM, Espié A, Bonnevialle N, Mansat P, Tricoire JL, Bonnevialle P, Chiron P, Puget J. Posterior dislocation of the sternoclavicular joint and epiphyseal disruption of the medial clavicle with posterior displacement in sports participants. J Bone Joint Surg Br 2010; 92-B: 103-109.
13. Quispe JC, Herbert B, Chadayammuri VP, Kim JW, Hao J, Hake M, Hak DJ, Stahel PF, Mauffrey C. Transarticular plating for acute posterior sternoclavicular joint dislocations: a valid treatment option? Int Orthop 2016; 40: 1503-1508.
14. Zhang C, Lin L, Liang J, Wang B, Chen G, Chen H. Efficacy analysis of a novel sternoclavicular hook plate for treatment of unstable sternoclavicular joint dislocation or fracture. J Orthop Surg (Hong Kong) 2017; 25: 2309499016684488.
15. Xin H, Wang X, Zhang S, Lin L, Chen H, Hong H. Novel sternoclavicular hook plate for the treatment of posterior sternoclavicular dislocation: a retrospective study. J Orthop Surg Res 2023; 18: 945.
16. Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological index for non-randomized studies (minors): development and validation of a new instrument. ANZ J Surg 2003; 73: 712-716.
17. Kent BE. Functional anatomy of the shoulder complex. A review. Phys Ther 1971; 51: 947.
18. Renfree KJ, Wright TW. Anatomy and biomechanics of the acromioclavicular and sternoclavicular joints. Clin Sports Med 2003; 22: 219-237.
19. Conway AM. Movements at the Sternoclavicular and Acromioclavicular Joints. Phys Ther 1961; 41: 421-432.
20. Kapandji IA. The Physiology of the Joints. Vol. I (New York, 2008).
21. Kiel J, Ponnarasu S, Kaiser K. Sternoclavicular Joint Injury. 2023. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.
22. Ferrera PC, Wheeling HM. Sternoclavicular joint injuries. Am J Emerg Med 2000; 18: 58-61.
23. Kane SM, Morris DV, Badana ANS. A Transarticular Approach to Posterior Sternoclavicular Dislocation: A Case Report. HSS J 2020; 16: 490-497.
24. Baumann M, Vogel T, Weise K, Muratore T, Trobisch P. Bilateral Posterior Sternoclavicular Dislocation. Orthopedics 2010; 33: 510.
25. Deren ME, Behrens SB, Vopat BG, Blaine TA. Posterior sternoclavicular dislocations: a brief review and technique for closed management of a rare but serious injury. Orthop Rev (Pavia) 2014; 6: 5245.
26. Jaggard MK, Gupte CM, Gulati V, Reilly P. A Comprehensive Review of Trauma and Disruption to the Sternoclavicular Joint With the Proposal of a New Classification System. J Trauma 2009; 66: 576-584.
27. Khorashadi L, Burns EM, Heaston DR, Warme WJ, Richardson ML. Posterior dislocation of the sternoclavicular joint. Radiol Case Rep 2015; 6: 439.
28. Cope R. Dislocations of the sternoclavicular joint. Skeletal Radiol 1993; 22: 233-238.
29. Marker LB, Klareskov B. Posterior sternoclavicular dislocation: an American football injury. Br J Sports Med 1996; 30: 71-72.
30. Gamez M. Posterior Dislocation of the Sternoclavicular Joint. Orthopaedic Nursing 2015; 34: 113-115.
31. Rockwood CA, Groh GI, Wirth MA, Grassi FA. Resection Arthroplasty of the Sternoclavicular Joint*. J Bone Joint Surg 1997; 79: 387-393.