

1 Appendix

2 A PubMed search was performed using the following keywords: “SIRVA” and/or "shoulder" and/or “injury" and/or "COVID-19"
 3 and/or "vaccination". Only publications written in English were included. In addition, we reviewed the reference lists of included
 4 studies to identify publications not found during the literature review. Table 1 provides a summary of 61 SIRVA cases representing a
 5 broad range of clinical presentations, the various vaccines involved, clinical course, investigations, diagnosis, and treatments.

Paper	Vaccines (Cases)	Epidemiology	Pathology/Diagnosis	Risk Factor(s)/ Clinical Course	Management
Bodor and Montalvo (2007) ¹	Pneumococcal (1)	71-year-old female, healthy	<ul style="list-style-type: none"> Subacromial bursitis (initial diagnosis) Adhesive capsulitis (final diagnosis) 	Risk Factor: <ul style="list-style-type: none"> Injection high into the right deltoid muscle (upper 1/3) Clinical Course: <ul style="list-style-type: none"> Right shoulder pain and reduced ROM within 48 hours 5 months later continued to experience shoulder pain, reduced ROM, and weakness Investigations: <ul style="list-style-type: none"> Nerve conduction and EMG unremarkable 	<ul style="list-style-type: none"> Physical therapy Diagnostic lidocaine 2% injection. No pain after 3 sequential injections in clinic Triamcinolone acetonide 40 mg/ml 1ml mixed with lidocaine 2% injections into the subacromial bursa, LHB tendon sheath and glenohumeral joint Analgesics: Acetaminophen and NSAIDs
	Influenza (1)	89-year-old male with history of mild intermittent shoulder pain	<ul style="list-style-type: none"> Bicipital tendonitis Subacromial bursitis 	Risk Factor: <ul style="list-style-type: none"> Injection high into the right deltoid muscle (upper 1/3) Clinical Course: <ul style="list-style-type: none"> Right shoulder pain and reduced ROM within 48 hours 2 months later, numbness in forearm region 4 months later, symptoms mostly resolved Investigations: <ul style="list-style-type: none"> Radiographs of the shoulder and cervical spine revealed mild degenerative changes. Nerve conduction and EMG studies unremarkable 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injections to the subacromial bursa, LHB tendon sheath and glenohumeral joint. Symptoms improved after 3 injections Analgesics: Acetaminophen
McColgan and Borschke (2007) ²	23-valent pneumococcal polysaccharide vaccine (1)	89-year-old female, history of rheumatoid arthritis and osteoporosis	<ul style="list-style-type: none"> Pseudoseptic arthritis 	Risk Factor: <ul style="list-style-type: none"> Injection high into the right shoulder Clinical Course: <ul style="list-style-type: none"> Right shoulder pain and restricted ROM within 2 hours after vaccine administration Physical exam revealed a moderate-sized GH joint effusion that was warm and painful on palpation Arthroscopic irrigation and debridement 	<ul style="list-style-type: none"> Surgery: arthroscopic I+D Antibiotics (Clindamycin and Vancomycin) Physical therapy

				<ul style="list-style-type: none"> Symptoms improved over the next two weeks <p>Investigations:</p> <ul style="list-style-type: none"> Elevated WBC 14,000 and normal CRP GH joint aspirate revealed a turbid fluid with WBC count of 10,700 (85% PMN, 4% lymphocytes, 11% monocytes); glucose 96; protein 4.9; and LDH >1200. Negative gram stain. No crystals. Repeat GH joint aspirate the next day revealed bloody turbid fluid with WBC Count 70,100 (93% PMN, 1% lymphocytes, 6% monocytes); glucose 80; protein 4.0; and LDH >1200. Negative gram stain and culture. No crystals. Repeat CRP was elevated at 111 Arthroscopy demonstrated chronic rotator cuff tear and a long head biceps rupture of indeterminate age 	
Atanasoff et al. (2010) ³	Influenza (8) Td (2) DTaP (2) HPV (1)	Mean age: 50 years (range, 26-83 years) 11 female / 2 male	<ul style="list-style-type: none"> Subacromial bursitis Rotator cuff tendonitis/tears 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle (6) <p>Clinical Course:</p> <ul style="list-style-type: none"> Shoulder pain was immediate (7), within 24 hours (5), and within 4 days (1) Limited ROM (11), altered sensation (4), weakness (4) Full recovery (4), residual symptoms (9) <p>Investigations:</p> <ul style="list-style-type: none"> Radiographs (7) were not diagnostic MRI (9) revealed fluid collections in deep deltoid/overlying tendons, fluid in bursa, tendonitis, and tears EMGs (5) were not diagnostic 	<ul style="list-style-type: none"> Physical therapy (6) Corticosteroid injection (8) Surgery (4): bursectomy Analgesics: NSAIDs (8)
Kuether et al. (2011) ⁴	Influenza A- (H1N1) v2009 (1)	48-year-old female, healthy	<ul style="list-style-type: none"> Osteonecrosis of the humeral head 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain, swelling, and erythema within 2.5 hours of vaccination At 12 months, continued to have pain with active ROM <p>Investigations:</p> <ul style="list-style-type: none"> At 9 weeks, CBC, ESR, CRP, liver enzymes, PT/PTT were normal At 2 months, MRI revealed osteonecrosis of the humeral head with subacromial/subdeltoid bursitis At 4 months, MRI revealed signs of reduced bursitis 	<ul style="list-style-type: none"> Physical therapy Intramuscular injections of prednisolone and diclofenac into the right gluteus muscle Bisphosphonates, vitamin D3, calcium Analgesics: Acetaminophen, Ibuprofen, Tramaldolor, Valoran

				<ul style="list-style-type: none"> At 12 months, MRI revealed reduction in necrosis and signs of regeneration in necrotic region 	
Barnes et al. (2012) ⁵	Influenza (1)	22-year-old female, healthy	<ul style="list-style-type: none"> Subacromial bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain within 2 hours of vaccination Progressive pain over 6 weeks, with reduced ROM At 16 months, full recovery attained <p>Investigations:</p> <ul style="list-style-type: none"> Normal shoulder radiographs At 8 weeks, MRI revealed an effusion within the subacromial bursa, a longitudinal partial tear of the supraspinatus tendon, and a bony contusion At 9.5 weeks, US imaging demonstrated a partial tear of the supraspinatus tendon as well as cortical irregularity on the superolateral humeral head at the point of injection At 11 weeks, repeat US demonstrated residual fluid at the supraspinatus tendon with a consistent cortical irregularity 	<ul style="list-style-type: none"> Physical therapy
Degreef and Debeer (2012) ⁶	Hepatitis-A (1)	36-year-old female, healthy	<ul style="list-style-type: none"> Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Shoulder pain within a few days of vaccination Developed significant restricted ROM at 6 weeks Presented to the physician at 2 months and treatment was initiated Pain resolved after 3 months with improved ROM <p>Investigations:</p> <ul style="list-style-type: none"> Normal shoulder radiographs and US 	<ul style="list-style-type: none"> Distension arthrography Physical therapy
	Influenza (1)	54-year-old male, history of hypertension	<ul style="list-style-type: none"> Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Progressive left shoulder pain after vaccine administration Physical exam at 2 months revealed limited shoulder ROM and treatment was initiated At 3 months symptoms had mostly resolved <p>Investigations:</p> <ul style="list-style-type: none"> Normal shoulder radiographs US demonstrated subacromial bursitis 	<ul style="list-style-type: none"> Distension arthrography Physical therapy
	Tetanus (1)	73-year-old female, healthy	<ul style="list-style-type: none"> Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Sudden onset right shoulder pain after vaccination 	<ul style="list-style-type: none"> Corticosteroid injection Distension arthrography Physical therapy

				<ul style="list-style-type: none"> At 6 months continue to have restricted ROM after corticosteroid injection Symptoms resolved 4 weeks after distension arthrography and physical therapy <p>Investigations:</p> <ul style="list-style-type: none"> Radiograph and US demonstrated minor calcifications around the greater tubercle 	
Floyd et al. (2012) ⁷	23-valent pneumococcal polysaccharide vaccine (1)	59-year-old female, history of asthma	<ul style="list-style-type: none"> Pseudoseptic arthritis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Thin body habitus <p>Clinical Courses:</p> <ul style="list-style-type: none"> Left shoulder pain, erythema, swelling, and fever within 2 hours of vaccination Arthroscopic irrigation and debridement Symptoms resolved after 12 weeks <p>Investigations:</p> <ul style="list-style-type: none"> Normal CBC Elevated CRP and ESR GH joint revealed a white cell count of 12,125/μL with 84% polymorphonuclear leukocytes and negative gram stain MRI demonstrated full-thickness tear of the rotator cuff, fluid in the subacromial/subdeltoid bursa, and subcutaneous edema Intraoperative culture was negative 	<ul style="list-style-type: none"> Surgery: arthroscopy I+D IV Cefazolin Q8H for 3 days Physical therapy
Messerschmitt et al. (2012) ⁸	Influenza (1)	46-year-old male, with a history of open Bankart repair 13 years ago	<ul style="list-style-type: none"> Progressive osteolysis of the proximal humerus and chondrolysis of the humeral head 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle <p>Clinical Courses:</p> <ul style="list-style-type: none"> Immediate left shoulder pain At 3 years, full recovery attained <p>Investigations:</p> <ul style="list-style-type: none"> At 3 weeks, radiographs revealed a small lytic area involving the greater tuberosity of the humeral head At 3 weeks, MRI revealed cystic changes involving the greater tuberosity of the humeral head CBC, CRP, ESR were normal 5 months later MRI showed progression Arthroscopy revealed a hyperemic joint capsule and extensive chondrolysis 	<ul style="list-style-type: none"> Surgery: Humeral head resurfacing arthroplasty and biceps tenodesis Analgesic: NSAIDs Physical therapy
Shaikh et al. (2012) ⁹	Influenza (1)	46-year-old female, healthy	<ul style="list-style-type: none"> Brachial neuritis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Thin body habitus <p>Clinical Courses:</p> <ul style="list-style-type: none"> Left shoulder pain a few days after vaccination At 1 week, physical exam revealed left arm weakness (1/5) 	<ul style="list-style-type: none"> Oral prednisolone

				<ul style="list-style-type: none"> At 8 weeks pain resolved but had persistent mild weakness <p>Investigations:</p> <ul style="list-style-type: none"> US did not reveal joint arthritis, adhesive capsulitis, calcific tendinitis, rotator cuff muscle or tendon tears or tendinopathy Normal cervical spine MRI EMG demonstrated axonal denervation of deltoid and supraspinatus 	
Uchida et al. (2012) ¹⁰	HPV (1)	45-year-old female, healthy	<ul style="list-style-type: none"> Subacromial bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle <p>Clinical Courses:</p> <ul style="list-style-type: none"> Left shoulder pain within 3 hours of receiving her third HPV vaccine, and progressively worsening pain and restricted ROM Symptoms persisted for 6 months Arthroscopic synovectomy and subacromial decompression Pain resolved 1 week later, and at 12 months all her symptoms resolved <p>Investigations:</p> <ul style="list-style-type: none"> Normal radiographs MRI demonstrated acute subacromial bursitis Elevated ESR and CRP Arthroscopy at 6 months revealed adhesive/inflammatory tissue, and small particles inside the subacromial bursa 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injection
Imran and Hayley (2013) ¹¹	Influenza (1)	73-year-old male, healthy	<ul style="list-style-type: none"> Axillary nerve injury 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Courses:</p> <ul style="list-style-type: none"> Left shoulder pain immediately after vaccine administration At 5 weeks started developing weakness with abduction Physical exam revealed atrophy of left deltoid and sensory loss on the lower half of the deltoid muscle. Tender on palpation and reduced active ROM. Passive ROM was preserved. Deep tendon reflexes were normal. Noticeable improvements in ROM 6 weeks after initiation of treatment <p>Investigations:</p> <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Physical therapy Oral analgesic
Cook (2014) ¹²	Influenza (1)	76-year-old male, history of ischemic heart disease	<ul style="list-style-type: none"> Impingement syndrome (initial diagnosis) 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection was felt to be high in the deltoid muscle <p>Clinical Course:</p>	<ul style="list-style-type: none"> Corticosteroid injection into the subacromial bursa

			<ul style="list-style-type: none"> Subacromial bursitis (final diagnosis) 	<ul style="list-style-type: none"> Immediate left shoulder pain Symptoms resolved 1 month after treatment <p>Investigations:</p> <ul style="list-style-type: none"> US demonstrated subacromial bursitis 	
Okur et al. (2014) ¹³	Influenza (4)	Mean age: 50 years (range, 36-66 years) 2 female / 2 male	<ul style="list-style-type: none"> Bursitis (2) Rotator cuff tear (1) Bone marrow edema within the greater tuberosity (2) 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Mean BMI: 27.0 kg/m² (range, 22.7-37.2 kg/m²) <p>Clinical Course:</p> <ul style="list-style-type: none"> Shoulder pain within 2 days (4) Reduced ROM on physical exam (2) Mean time to resolution: 2 months (range of 1-6 months) <p>Investigations:</p> <ul style="list-style-type: none"> Elevated ESR (1) Leukopenia (1) Normal CBC (3) MRI demonstrated soft tissue edema (3), fluid within subacromial/subdeltoid bursa (2), bone marrow edema (2), and tear of supraspinatus and infraspinatus tendons (1) 	<ul style="list-style-type: none"> Physical therapy (1) Analgesic: NSAIDs (4)
Hexter et al. (2015) ¹⁴	Influenza (1)	51-year-old-female, healthy	<ul style="list-style-type: none"> Glenohumeral synovitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the left deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain immediately Persisting pain and reduced ROM for the next 5 months Initially diagnosed as adhesive capsulitis 6 weeks after arthroscopy, symptoms resolved <p>Investigations:</p> <ul style="list-style-type: none"> Normal shoulder radiographs MRI demonstrated subacromial and subdeltoid bursitis, supraspinatus tendinopathy, bone edema in humeral head Arthroscopy at 5 months revealed thickening of the middle glenohumeral and coracohumeral ligaments, a partial-thickness tear of the supraspinatus and extensive synovitis throughout the GH joint Biopsy of GH synovial tissue demonstrated synovioyte hypertrophy and hyperplasia 	<ul style="list-style-type: none"> Surgery: arthroscopic synovectomy, arthrolysis of the contracted ligaments, joint washout, bursectomy and anterior third acromioplasty Corticosteroid injection Physical therapy
Saleh et al. (2015) ¹⁵	Pneumococcal (1)	67-year-old male, on Simvastatin, iron, and aspirin daily	<ul style="list-style-type: none"> Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain and reduced ROM within 24 hours Progressive weakness over the next few weeks to months 	<ul style="list-style-type: none"> Corticosteroid injection Physical therapy Activity modification Analgesic: NSAIDs

				<ul style="list-style-type: none"> Symptoms resolved after 20 months Investigations: <ul style="list-style-type: none"> MRI demonstrated mild AC joint arthropathy and rotator cuff tendinopathy Radiograph demonstrated degenerative changes of the AC joint and GH joints, without proximal humeral head migration or osseous abnormalities. Repeat MRI demonstrated no rotator cuff tear 	
	Influenza (1)	30-year-old male, healthy	<ul style="list-style-type: none"> Adhesive capsulitis 	Risk Factor: <ul style="list-style-type: none"> None identified Clinical Course: <ul style="list-style-type: none"> Left shoulder pain and reduced ROM soon after vaccine administration Pain and ROM gradually improved over time, but residual pain persisted for 2 years Investigations: <ul style="list-style-type: none"> Radiograph demonstrated a type II acromion with no joint abnormalities, no proximal migration of the humeral head, and no osseous abnormalities 	<ul style="list-style-type: none"> Activity modification Analgesics: NSAIDs
	Influenza (1)	69-year-old female, history of hypertension, COPD, and arthritis	<ul style="list-style-type: none"> Adhesive capsulitis 	Risk Factor: <ul style="list-style-type: none"> None identified Clinical Course: <ul style="list-style-type: none"> Left shoulder pain, swelling and reduced ROM within 24 hours Progressive weakness over the next few weeks to months Symptoms resolved after 20 months Investigations: <ul style="list-style-type: none"> Radiographs demonstrated a well preserved GH joint with mild degenerative changes, and no osseous abnormalities or proximal head migration 	<ul style="list-style-type: none"> Physical therapy Analgesics: NSAIDs
Salmon et al. (2015) ¹⁶	Diphtheria, tetanus and poliomyelitis (1)	26-year-old female, healthy	<ul style="list-style-type: none"> Subacromial bursitis (initial diagnosis) Bone erosion (final diagnosis) 	Risk Factor: <ul style="list-style-type: none"> Injection high into the right deltoid muscle (upper 1/3) Clinical Course: <ul style="list-style-type: none"> Left shoulder pain and reduced ROM within 48hrs Investigations: <ul style="list-style-type: none"> Normal shoulder radiographs US and MRI performed 2 days after the injection revealed an effusion of the glenohumeral joint and subacromial-subdeltoid bursitis Aspiration: The liquid was light yellow, with 320 leucocytes/mm³, culture negative, no crystals MRI performed at 5 months revealed regression. Bone edema appeared at the upper, outer part of 	<ul style="list-style-type: none"> Corticosteroid injection Analgesic: NSAIDs

				the humeral head, with a slight cortical irregularity corresponding to a bony erosion	
Cross et al. (2016) ¹⁷	23-valent pneumococcal polysaccharide vaccine (1)	82-year-old female, with history of osteoarthritis, osteoporosis, hypothyroidism, bilateral total hip arthroplasty	<ul style="list-style-type: none"> Complete tear of left supraspinatus tendon Subdeltoid bursitis LHB tendonitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> The vaccination site was injected 1 cm inferior to the acromion process ('high injection') <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain and reduced ROM 2 hours after injection Fever at 37.7°C with red and warm shoulder joint <p>Investigations:</p> <ul style="list-style-type: none"> US revealed moderate subdeltoid bursal collection that communicated with the shoulder joint Serum white blood cell count was 9.0 x 10⁹/L. C-reactive protein tested three days after presentation was elevated at 363 mg/L The bursal collection was percutaneously drained and microscopy revealed 98,000 x 10⁶/L WBCs, 420 x 10⁶/L RBCs, with no crystals present Repeat US performed 10 days after joint washout showed persistent subdeltoid bursitis and LHB tendonitis 	<ul style="list-style-type: none"> Surgery: surgical irrigation and debridement of left shoulder due to concern for septic arthritis/bursitis (negative fluid culture results) Intravenous flucloxacillin Physical therapy
	DTaP (1)	23-year-old female, healthy	<ul style="list-style-type: none"> Subacromial bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain and reduced ROM started within 24 hours Painful arc with active shoulder abduction Symptoms resolved after 3 months <p>Investigations:</p> <ul style="list-style-type: none"> An ultrasound revealed subacromial bursal thickening that was consistent with subacromial bursitis. 	<ul style="list-style-type: none"> Subacromial corticosteroid injection Analgesics: NSAIDs
DeRogatis et al. (2018) ¹⁸	23-valent pneumococcal polysaccharide vaccine (1)	90-year-old female, with a history of asthma and hypertension	<ul style="list-style-type: none"> Septic arthritis of the right glenohumeral joint 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain and reduced ROM started within 24 hours At 1 week admitted to hospital for generalized weakness, decreased appetite. Had a temperature of 38.9°C Symptoms resolved 3 months after surgery <p>Investigations:</p> <ul style="list-style-type: none"> At 1 week, normal shoulder radiographs Elevated CRP and ESR. 	<ul style="list-style-type: none"> Surgery: shoulder arthrotomy, irrigation, and debridement Postoperative antibiotics (Vancomycin)

				<ul style="list-style-type: none"> US revealed hypoechoic fluid collection anterior to the proximal humerus measuring 2.2 × 0.6 × 1.8 cm MRI revealed a large shoulder joint effusion Pathology of surgical sample returned positive for MRSA 	
Erickson et al. (2019) ¹⁹	Influenza (1)	51-year-old female, healthy	<ul style="list-style-type: none"> Lytic lesion in the proximal humerus Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the left deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain and reduced ROM started within 24 hours Rheumatologic bloodwork normal Symptoms resolved 1 year after arthroscopic bone and soft-tissue debridement <p>Investigations:</p> <ul style="list-style-type: none"> Normal radiographs At 2 months, MRI revealed a partial-thickness rotator cuff tear with a small hyperintense area on the posterior aspect of the rotator cuff footprint At 3 months, ultrasound guided joint aspiration: culture negative At 10 months, MRI revealed increase in signal within the humeral head with bony erosion At 11 months, CT scan revealed a large lytic lesion in the proximal humerus 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injections Surgery: arthroscopic debridement of bone and soft-tissue lesions Analgesics: NSAIDs
Shahbaz et al. (2019) ²⁰	Influenza (1)	35-year-old female, healthy	<ul style="list-style-type: none"> Tenosynovitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the left deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> 10 out of 10 left shoulder pain within 1 hour of vaccine administration. Followed by stiffness. Physical exam revealed deltoid pain and reduced ROM, but no bruising, erythema, or swelling. Reflexes, strength, and sensation were intact. Continue to have 3 out of 10 pain and restricted ROM at 8 months <p>Investigations:</p> <ul style="list-style-type: none"> MRI within 1 week demonstrated moderate GH joint effusion and synovitis, with fluid accumulating in the subscapularis recess, in addition to changes consistent with a moderate biceps' tenosynovitis MRI at 6 weeks demonstrated near-complete resolution of the GH joint effusion, but changes consistent with tenosynovitis of the biceps' tendon remained 	<ul style="list-style-type: none"> Physical therapy Activity modification Analgesic: NSAIDs 5% lidocaine patch

				<ul style="list-style-type: none"> MRI at 8 months demonstrated persistent mild tenosynovitis of the long head of the biceps tendon, interval accumulation of a large GH joint effusion, and infraspinatus tendinitis with subjacent reactive bone marrow edema 	
Szari et al. (2019) ²¹	Influenza (1)	31-year-old male, history of right shoulder and lower back pain	<ul style="list-style-type: none"> Small partial thickness tear of the supraspinatus, possible calcific tendinopathy of the distal teres minor, and underlying humeral head edema 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Immediate left shoulder pain after vaccine administration Pain and reduced ROM persisted for 6 months with incomplete resolution of symptoms <p>Investigations:</p> <ul style="list-style-type: none"> CBC and ESR were normal MRI demonstrated tendinopathy of the left distal subscapularis, infraspinatus, supraspinatus, and teres minor tendon 	<ul style="list-style-type: none"> Corticosteroid injection Analgesics: NSAIDs
Wright et al. (2019) ²²	Influenza (1)	72-year-old female, with a history of hypertension	<ul style="list-style-type: none"> Subacromial/subdeltoid bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Immediate pain after administration At 2 weeks, increasing right shoulder pain and reduced ROM <p>Investigations:</p> <ul style="list-style-type: none"> CBC and ESR were normal Normal shoulder radiographs At 4 weeks, MRI revealed hyperintense signal abnormality within the subacromial/subdeltoid bursa At 6 weeks, US revealed residual fluid in the subacromial/subdeltoid bursa, and small partial thickness tear of subscapularis/infraspinatus tendon 	<ul style="list-style-type: none"> Corticosteroid injection Analgesics: NSAIDs
Macomb et al. (2020) ²³	23-valent pneumococcal polysaccharide vaccine (1)	69-year-old female, with history of asthma, hypothyroidism, osteopenia, bilateral knee osteoarthritis, prediabetes, and nonobstructive coronary artery disease	<ul style="list-style-type: none"> Bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain and reduced ROM within 24 hours Symptoms resolved after 1 month 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injection Analgesics: NSAIDs
	Recombinant zoster vaccine (1)	84-year-old male, with history of stage IV chronic kidney disease, type 2 diabetes, gout, and hypertension	<ul style="list-style-type: none"> Bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain and reduced ROM within 12 hours 	<ul style="list-style-type: none"> Corticosteroid injection

				<ul style="list-style-type: none"> Symptoms resolved after 1 month 	
Natanzi et al. (2020) ²⁴	Influenza (1)	42-year-old female, healthy	<ul style="list-style-type: none"> Teres minor injury with humeral head edema 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Administrator standing with patient sitting Injection high into the deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Immediate pain after administration, which peaked at 72 hours 7 weeks post-vaccination revealed weakness and limitation of ROM with signs of impingement and tenderness at the injection site <p>Investigations:</p> <ul style="list-style-type: none"> MRI at 12 weeks revealed edema involving the teres minor tendon insertion and the underlying humerus 	<ul style="list-style-type: none"> Unknown
	Influenza (1)	38-year-old female, healthy	<ul style="list-style-type: none"> Teres minor injury with humeral head edema 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Administrator standing with patient sitting Injection high into the deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Physical examination 2 months after the vaccination revealed shoulder swelling, tenderness, and an inability to raise or extend her arm without pain and signs of impingement <p>Investigations:</p> <ul style="list-style-type: none"> MRI of the left shoulder 1 week later demonstrated edema at the teres minor tendon insertion and underlying humerus 	<ul style="list-style-type: none"> Unknown
Thompson and Ensrud (2020) ²⁵	Influenza (1)	64-year-old male, healthy	<ul style="list-style-type: none"> Bilateral adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the left deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Left shoulder pain started a few days after vaccine administration. A few days later similar pain started in right shoulder. Reduced active ROM. Symptoms persisted for 6 months 3 months after corticosteroid injection there is marked improvements in shoulder pain and ROM <p>Investigations:</p> <ul style="list-style-type: none"> Radiographs unremarkable MRI demonstrated bilateral thickening and edema of the inferior GH ligaments with loss of fat in the rotator interval 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injection
Batra and Page (2021) ²⁶	Influenza (5)	<p>Mean age: 34 years (range, 29-38 years)</p> <p>5 female / 0 male</p>	<ul style="list-style-type: none"> Bursitis Tendonitis Adhesive capsulitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle (3) <p>Clinical Course:</p> <ul style="list-style-type: none"> Shoulder pain was immediate (3), within 24 hours (1), and within 48 hours (1) Shoulder pain (5) and reduced ROM (5) 	<ul style="list-style-type: none"> Physical therapy Modified job duties Medrol Dosepak (steroids) Intra-articular corticosteroid injection Analgesics: NSAIDs

				<ul style="list-style-type: none"> Symptoms resolved within 5 weeks of treatment (5) 	
Cantarelli Rodrigues et al. (2021) ²⁷	ChAdOx1 nCoV-19 (Oxford-AstraZeneca) (1)	61-year-old female, with a history of hypothyroidism	<ul style="list-style-type: none"> Subacromial/sub-deltoid bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain within 30 mins Reduced active ROM <p>Investigations:</p> <ul style="list-style-type: none"> Normal shoulder radiographs At 8 weeks, MRI and US revealed subacromial-subdeltoid bursitis and rotator cuff tendinopathy 	<ul style="list-style-type: none"> Physical therapy Topical diclofenac Carisoprodol Analgesics: NSAIDs, paracetamol, caffeine Vitamin D Prednisone
Flowers et al. (2021) ²⁸	Pfizer-BioNTech mRNA COVID-19 vaccine (1)	68-year-old female, with a history of hypertension, high cholesterol, hypothyroidism, rotator cuff disease	<ul style="list-style-type: none"> Septic arthritis of the GH joint 	<p>Risk Factor:</p> <ul style="list-style-type: none"> None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> Localized left shoulder tenderness and swelling progressed to severe pain, limited ROM, fever, and rigours within 7 days of vaccination <p>Investigations:</p> <ul style="list-style-type: none"> Labs: normal serum WBC count, elevated ESR and CRP; normal blood cultures Radiographs: mild AC joint arthritis MRI: large GH joint effusion, synovitis, diffuse rotator cuff tendinosis and tears of the supraspinatus/subscapularis tendons. No evidence of osteomyelitis. Joint aspirate: synovial WBC count 130,000/mm³; negative gram stain Intraoperative cultures grew <i>Streptococcus gordonii</i> (viridans group) 	<ul style="list-style-type: none"> Surgery: open irrigation and debridement of shoulder joint and subacromial space; subtotal bursectomy Postoperative physical/occupational therapy for post-infectious adhesive capsulitis Extended course of postoperative antibiotics (6 weeks)
Wong et al. (2021) ²⁹	Influenza (1)	51-year-old female, healthy	<ul style="list-style-type: none"> Bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Multiple redirections of the needle while injecting the vaccine <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain and reduced ROM within 48 hours Symptoms resolved 3 months after arthroscopy <p>Investigations:</p> <ul style="list-style-type: none"> At 12 weeks, MRI revealed rotator cuff bursitis and bursal foreign body reaction 	<ul style="list-style-type: none"> Physical therapy Corticosteroid injections to the subacromial bursa Surgery: arthroscopic subacromial bursectomy Analgesics: NSAIDs
Chuaychoosakoon et al. (2021) ³⁰	Sinovac SARS-CoV-2 vaccine (1)	52-year-old male, with ipsilateral advanced GH joint arthritis (asymptomatic)	<ul style="list-style-type: none"> Subacromial/subcoracoid/subdeltoid bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Length (1.5 inches in length) and direction (45° angle) of needle insertion <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain, swelling in deltoid region, limited ROM and fever within 72 hours 	<ul style="list-style-type: none"> Physical therapy IV and oral antibiotics (10 days)

				<ul style="list-style-type: none"> Clinical improvement after 3 days of hospital admission and instituting treatment <p>Investigations:</p> <ul style="list-style-type: none"> Radiographs: advanced GH joint arthritis US: subacromial-subcoracoid-subdeltoid bursitis Labs: normal serum WBC, CRP, and ESR Bursal fluid aspirate: 5cc of serosanguinous fluid; WBC count <50,000 cells/mm³; no organisms isolated 	
Boonsri et al. (2021) ³¹	ChAdOx1 nCoV-19 vaccine (Oxford-AstraZeneca) (1)	51-year-old female, healthy; denies previous shoulder problems	<ul style="list-style-type: none"> Combined subacromial-subdeltoid bursitis and supraspinatus tendon tear 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection high into the deltoid muscle (1 finger breadth from lateral acromial margin) Improper needle length <p>Clinical Course:</p> <ul style="list-style-type: none"> Right shoulder pain within 3 hours of the vaccination Symptoms resolved days after starting oral NSAIDs <p>Investigations:</p> <ul style="list-style-type: none"> Radiographs: soft tissue swelling; inferior subluxation of the humeral head; cortical irregularities of the greater tuberosity Ultrasound: subacromial-subdeltoid bursitis; small full-thickness tear of the posterior supraspinatus 	<ul style="list-style-type: none"> Analgesics: NSAIDs
Littrell et al. (2021) ³²	Influenza (1)	51-year-old male, healthy	<ul style="list-style-type: none"> Bursitis, synovitis, and bone erosion 	<p>Risk Factor:</p> <ul style="list-style-type: none"> Injection was 1 cm distal to the lateral edge of the acromion BMI 21 kg/m² <p>Clinical Course:</p> <ul style="list-style-type: none"> Shoulder pain began 2 hours after vaccination Progressive pain and reduced ROM over the next 6 weeks Initially diagnosed with adhesive capsulitis Symptoms resolved after 32 months <p>Investigations:</p> <ul style="list-style-type: none"> Labs: normal WBC, ESR, CRP Normal rheumatoid factor and cyclic citrullinated peptide antibodies GH joint aspiration did not yield any fluid MRI at 6 weeks demonstrated subacromial/subdeltoid bursitis, cortical erosion, synovitis MRI at 5 months demonstrated progressive bursitis, erosive changes of the greater tuberosity, and synovitis of the GH joint and AC joint Indium white blood cell/sulfur colloid marrow scan and 3-phase technetium 99m-methyl 	<ul style="list-style-type: none"> Physical therapy Analgesics: NSAIDs Corticosteroid injection

				<p>diphosphonate bone scan showed increased WBC uptake due to activated bone marrow in humeral head</p> <ul style="list-style-type: none"> • Radiographs at 32 months demonstrated no further progression of erosive changes 	
Honarmand et al. (2021) ³³	mRNA – 1273 SARS-CoV-2 vaccine (Moderna) (1)	42-year-old male, healthy	<ul style="list-style-type: none"> • Subacromial-subdeltoid bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> • Injection high into the deltoid muscle <p>Clinical Course:</p> <ul style="list-style-type: none"> • Severe left shoulder pain and limited ROM 2 days after receiving the first dose <p>Investigations:</p> <ul style="list-style-type: none"> • MRI showed subacromial-subdeltoid bursitis 	<ul style="list-style-type: none"> • Shoulder pain subsided in a few days after receiving a single course of oral prednisolone • Follow-up MRI 2 months later showed resolution of bursitis
	BNT162b2 mRNA SARS-CoV-2 vaccine (Pfizer-BioNTech) (1)	38-year-old female, healthy	<ul style="list-style-type: none"> • Subacromial-subdeltoid bursitis 	<p>Risk Factor:</p> <ul style="list-style-type: none"> • None identified <p>Clinical Course:</p> <ul style="list-style-type: none"> • Severe left shoulder pain and limited ROM 2 weeks after receiving the second dose <p>Investigations:</p> <ul style="list-style-type: none"> • US showed subacromial-subdeltoid bursitis 	<ul style="list-style-type: none"> • Near complete resolution of symptoms in 1 week following conservative care (not further specified)

6 Table 1: Summary of the epidemiology, clinical presentation, and management of confirmed SIRVA cases from the literature.

7 Abbreviations: Td denotes tetanus, diphtheria; DTap diphtheria, tetanus, with acellular pertussis; HPV human papillomavirus; NSAIDs non-
8 steroidal anti-inflammatory drugs; ROM range of motion; LHB long head biceps; US ultrasound; MRI magnetic resonance imaging; CT computed
9 tomography; CBC complete blood count; RBC red blood cells; WBC white blood cells; PT prothrombin time; PTT partial thromboplastin time;
10 CRP C-reactive protein; ESR erythrocyte sedimentation rate.

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