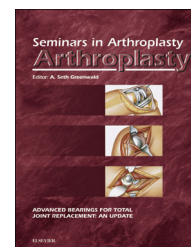


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# Common pain generators after total shoulder arthroplasty and their pesky relatives

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## ABSTRACT

Although anatomic and reverse total shoulder arthroplasty (TSA) are generally very successful procedures with predictable pain relief, a small percentage of patients experience refractory pain postoperatively. Common etiologies of pain following such surgery are infection and joint instability in the early postoperative period, as well as implant loosening beyond 2 years postoperatively. However, once these causes of pain are ruled out, less common etiologies should be considered. These less common causes of postoperative pain include psychological factors (i.e., depression and anxiety), physiologic (i.e., narcotic dependence and neurologic), mechanical (i.e., symptomatic hardware and acromioclavicular arthritis), or secondary gain (i.e., workman's compensation and insurance issues).

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## 1. Introduction

With the rapid growth in primary total shoulder arthroplasties (TSA), a thoughtful consideration of the painful TSA has become very important. Although TSA generally gives reliable pain relief in addition to functional improvement, a recent systematic review of nonconstrained arthroplasties demonstrated a 22.6% overall rate of complications, increasing to 29.6% in studies with >5 years of follow-up [1]. The advent and increasing popularity of the reverse shoulder arthroplasty (RSA) has demonstrated an even greater incidence of complications with a steeper learning curve than TSA [2–4].

Pain is the most common reason for patients with a failed shoulder arthroplasty to seek consultation, as one study demonstrated 241 of 282 unsatisfactory arthroplasties identified pain as the main reason for their presentation [5]. When evaluating the etiology underlying this pain, certain details from the history are critical, including whether there

was ever a period of time after the initial surgery where the patient was pain-free, the quality of the pain, the presence of frequent night pain, and its association with specific activities.

Many of the most common causes of pain are associated with a specific identifiable etiology and are shared by both anatomic and reverse arthroplasties, such as implant loosening, periprosthetic fracture, or deep periprosthetic infections. Other common sources are component specific, such as rotator cuff failures in anatomic TSA or acromial/scapular fractures in RSA. These are often able to be identified through imaging (radiographs, computed tomography, and/or nuclear scans) or an infection work-up (inflammatory markers, aspiration, and/or biopsies).

The uncommon pain generators are often more difficult to identify, as they are often not associated with mechanical or anatomic problems. These include psychological or emotional factors, chronic narcotic dependence, chronic

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regional pain syndrome, neurologic injury, and other secondary factors, such as issues pertaining to workman's compensation or insurance. There are also several other uncommon mechanical/anatomic pathologies, including symptomatic hardware and/or missed diagnosis such as acromioclavicular arthritis. These uncommon etiologies of recurrent or continued pain after TSA are often very difficult to diagnose, and are commonly only considered once the other more common etiologies have been ruled out.

This review highlights the most common etiologies of pain after TSA, while also shedding light on the uncommon pain generators and evidence associated with them in the peer-reviewed literature.

## 2. Most common pain sources: mechanical, infection, or fracture

Evaluation of a patient with pain after an anatomic or reverse total shoulder arthroplasty should initially focus on the most common etiologies that are likely behind the patient's symptoms. These include mechanical factors, such as glenoid or humeral component loosening or joint instability, as well as periprosthetic fractures or deep infections. Furthermore, rotator cuff pathology should be a consideration in anatomic TSA, while acromial or scapular stress fractures are an important consideration in RSA. However, regardless of the timing or type of prosthesis, it is critical to always consider and rule out periprosthetic infection before beginning any further assessments in a patient with pain after a total shoulder arthroplasty (Table 1).

### 2.1. Implant loosening, infection, instability, and periprosthetic fracture: non-specific (anatomic and reverse) pain

Reverse and anatomic TSA share many of the common potential drivers of pain, including infection, implant loosening, instability, and periprosthetic fractures. The patient's timeline of symptom progression, their clinical examination, and radiographic evaluation are critical to distinguish between these common pain sources.

The timing of the symptom recurrence, or the presence/absence of a symptom-free interval has been shown to help

distinguish infection and instability from implant loosening. For example in anatomic TSA, Schoch et al. [6] examined 2786 anatomic shoulder arthroplasties performed at a single institution. Etiologies of early failure (within 2 years) included instability, rotator cuff tears, and infection, as 63% of reoperations occurred in this time period. After 2 years, the most common reasons for failure involved mechanical etiologies, including component loosening and periprosthetic fractures.

The importance of timing has also been demonstrated in RSA. In a study by Bacle et al. [7], 87 reverse shoulder replacements were followed for a minimum 10 years. The Constant scores decreased from 2 years to over 10 years on average, while 73% of shoulders exhibited scapular notching. Overall, 29% of patients experienced complications, including 10% occurring at 2 years postoperatively. Dislocations and infections were the most common in the first 2 years, while glenoid and humeral loosening were the most common complications after 2 years. Both of these studies reinforce the notion that within 2 years, instability and infection are important pain drivers, while after 2 years, component loosening is the driving factor, with periprosthetic fractures as a possibility in those with a history of an acute change after a traumatic event.

Periprosthetic joint infection is an important and unfortunately relatively common reason for pain after TSA. In the acute or subacute setting, patients often either never truly experience a symptom-free interval after the procedure. Furthermore, these infections can lead to other complications, such as component loosening or joint instability or even stiffness. Diagnosis is contingent upon a comprehensive infection work-up, involving serum inflammatory markers (e.g., ESR and CRP), joint aspiration, and in many cases arthroscopic biopsies. Although the true incidence of infection is largely unknown, it has been quoted to be between 1% and 3% in most studies [1,8–11]. Singh et al. [9] examined 2588 primary total shoulder arthroplasties, with 32 (1%) culture positive deep infections in the follow-up period. Staphylococcus species were the most common in the early years (before 2000), while *Propionibacterium acnes* was equally as common from 2001 to 2008. The 5-, 10-, and 20-year survival-free of infection was 99%, 98.5%, and 97%, respectively. The virulence of the organism and the source (direct wound contamination vs. hematogenous spread) often play a role in the type and quality of symptoms. Virulent organisms,

**Table 1 – Breakdown of Pain Sources.**

	Anatomic or Reverse TSA	Anatomic TSA	Reverse TSA
Common pain drivers			
<2 years	Infection Joint instability	Rotator cuff pathology	Acromial or scapular stress fracture
>2 years	Humeral or glenoid loosening Periprosthetic fracture	Rotator cuff pathology	Acromial or scapular stress fracture
Uncommon pain drivers			
Psychologic or emotional	Depression, anxiety, or other psychiatric illness		
Physiologic	Chronic narcotic dependence, neurologic injury, CRPS		
Mechanical or anatomic	Symptomatic hardware, acromioclavicular arthritis		
Other	Workman's compensation, insurance or disability concerns		

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