Fluid Management with Arthroscopic Shoulder Surgery

a report by

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Over the last 20 years, shoulder arthroscopy has developed from a diagnostic procedure to a therapeutic technique whereby almost every surgery that can be performed on a shoulder can be carried out through the arthroscope. One of the major concerns with the arthroscope involves the extravasation of fluid into the surrounding soft tissues. Fluid escaping into the soft tissues of the shoulder and periscapular region can be much more than just an inconvenience. While several authors have shown that there are no long-term sequelae from elevated pressures in the deltoid and rotator cuff musculature from fluid, other complications have been noted. Reports in literature have outlined many significant risks associated with fluid management failures, including tracheal compression. Many techniques have been advocated to try to reduce the amount of soft tissue swelling patients experience intra-operatively—some of these will be presented in this article.

Set-up

The correct set-up is critical for facilitating expeditious arthroscopic shoulder surgery. The longer a given surgery takes, the more time the fluid has to infiltrate the surrounding structures. Published reports of typical set-ups are available. By having the patient positioned well in the operating room (OR), and by having all of the appropriate surgical instruments available and accessible, a surgeon can significantly reduce operative time. This follows for planning the surgery in advance and also having a well-trained surgical team. A team that works well together will further reduce operative times, thereby reducing fluid issues with patients.

Management of Blood Pressure

Several studies have examined the interplay between patient blood pressure, particularly diastolic blood pressure, and visual clarity. While diastolic blood pressure increases, so does the need for increased pressure in the joint (in order to control bleeding). Consequently, relative hypotensive anesthesia has been shown to improve surgical visualisation and simultaneously reduce the amount of fluid extravasation into the peri-articular subcutaneous tissue. For procedures conducted under general anesthesia, more control of blood pressure is possible. Cases conducted under regional anesthesia are less amenable to blood pressure manipulation.

Preserving Portals

Preserving portals reduces soft-tissue swelling in two different ways. Firstly, it keeps the surgeon from needing to recreate the portals and thereby repuncturing the capsule. Each capsular hole provides another outlet for fluid to escape into the surrounding soft tissue. The fewer
capsular rents that are created, the better the native capsule can contain the arthroscopic irrigant and thereby reduce extravasation. Additionally, each lost portal amounts to longer time in the OR as the surgeon restores access to the shoulder. Different companies provide excellent portals for arthroscopic access. In many cases, threaded portals which "screw in" to the soft tissues can be relied upon to stay in the shoulder more reproducibly than unthreaded ones. However, even these portals can back out if not diligently preserved by members of the surgical team. While the shoulder becomes engorged with fluid, it is important to make sure that the cannulas that are used are long enough to cross the swollen tissues. If a lengthier procedure is anticipated, it may be worthwhile to place a longer cannula from the beginning of the procedure in anticipation of swelling. In certain situations, it may become necessary to change the cannula over a switching-stick to allow for swelling. Finally, it is important to use cannulas that provide watertight seals as turbulence has also been shown to decrease visibility. Occlusion of a leaking cannula can reduce this problem. Capped cannulas available from most manufacturers can assist with this.

**Control Bleeding**

The pathologies that lend themselves to shoulder arthroscopy and the surgeries they require can produce copious bleeding. When a bursal tissue becomes inflamed from impingement or a rotator cuff tear, arthrodebridement can cause significant bleeding. The first step required for control of bleeding is to meticulously find and cauterise any bleeding within the shoulder. Cloudy fluid is an uncontrolled bleed until proven otherwise. In addition, standard teaching is to reduce bleeding with increased pump pressure (because of experience in the knee). While this will often control the bleeding, it will also greatly increase the leakage of the fluid out of the capsule. The majority of arthroscopic procedures can be performed at 35mmHg as long as bleeding is rigorously controlled; as soon as the bleeding is noticed, the electrocautery is introduced and the bleeder coagulated. Often, when visibility is reduced, it is because of uncontrolled bleeding, which should be sought out and coagulated. In certain settings, such as when there is significant bone bleeding from the acromion or the distal clavicle, this cannot be coagulated. In these settings, increasing inflow pressure may be the only method of controlling the bleeding and restoring visibility. However, it is advisable to perform elevated pressure procedures as expeditiously as possible and also to use the lowest pressure that still provides adequate visibility.

**Using the Right Fluid**

At the Mount Sinai Medical Center, the authors use epinephrine in saline irrigation fluid at a ratio of 1:300,000. This assists with control of the small bleeds that could not otherwise be managed. At this concentration, it has been shown to be safe and without systemic side effects from the epinephrine. Some institutions prefer a concentration of 1:3,000,000. In the authors’ practice, only patients who have significant cardiac arrhythmias or a prior reaction to epinephrine solution need to use this lower concentration. Epinephrine saline solution has also been shown to reduce the amount of intra-operative bleeding and improve operative clarity. Subsequently, this inexpensive and safe addition to arthroscopic set-up is a powerful adjunct for shoulder arthroscopy.

**Using a Pump**

Use of a pump-driven rather than a gravity inflow system provides more effective control of intra-operative bleeding. Pump systems that have separate control of flow rate and pressure have been shown to have less extravasation as well as better clarity intra-operatively, particularly with longer or more complex procedures. There are many of these systems currently available on the market. Systems that allow direct control of both variables by the surgeon, by remote control or by foot pedal, have also been shown to have reduced problems with extravasation.

These tricks of the trade coupled with experience on the part of the surgeon and the surgical team will greatly reduce fluid extravasation and consequently reduce the number of complications associated with extravasation. In this way, patients can not only be made more comfortable post-operatively, but can also be made less likely to have any of the rare associated complications from fluid management in shoulder arthroscopy.

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