Postoperative airway compromise in shoulder arthroscopy: A case series

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ABSTRACT

Shoulder arthroscopy is a routine procedure performed for diagnostic and therapeutic purposes. Complications related to patient positioning and anaesthesia are not infrequent. Airway compromise is related to the duration of surgery, surgical technique and equipment, amount of irrigation fluid used and limited access to the patient. Thorough knowledge, both by surgeon and anaesthesiologist, is the key to anticipate, prevent and treat this complication early.

Key words: Airway compromise, extravasation, irrigation fluids, shoulder arthroscopy

INTRODUCTION

Sholder arthroscopy is a minimally invasive technique with documented complications.[1-3] Published reports include extravasation of irrigating fluids and related airway compromise, vascular and neurologic injury, iatrogenic tendon and cartilage injury, joint stiffness and infection.[4,5] Causes of respiratory compromise include air embolism, pneumothorax, pneumomediastinum, tracheal compression and oedema related airway obstruction.[1,6] Improvement in surgical/anaesthetic technique and equipment can prevent these life threatening complications.[7]

We describe three cases with airway compromise in the immediate postoperative period. All these patients had elective shoulder arthroscopy in lateral decubitus position under general anaesthesia (GA). Preoperative evaluation was within normal limits. Anaesthesia was induced with propofol, fentanyl and maintained with isoflurane, nitrous oxide-oxygen mixture and vecuronium. Monitoring used were Electrocardiogram (ECG), pulse oximetry, noninvasive blood pressure, capnograph and airway pressure. Normal saline irrigation fluid was used with pump and flow regulation. Intraoperative haemodynamics remained stable and no complications were encountered during the procedure. Clinical manifestation of airway oedema in the early postoperative period, required immediate intervention and intensive management.

CASE REPORTS

Case 1

52 years diabetic male, weighing 80 kg underwent an arthroscopic repair of right subscapular tear. Surgical duration was 4.5 hrs, irrigation fluid used was 48 litres (L). Swelling of chest, anterior portion of neck extending to face was noted. Trial extubation was done since there was no airway compromise. On arrival to recovery room, patient complained of breathing difficulty, inability to speak and rapidly desaturated. Facial mask ventilation was difficult. Intubation was successful in 2nd attempt with 8.5 mm endotracheal tube (ETT). Significant soft tissue swelling was noted in oral cavity, tongue and false cords. Laryngeal and tracheal oedema was unlikely, as the ETT cuff required inflation to prevent air leak. Positive pressure ventilation with 100% oxygen restored saturation. He was electively ventilated in the intensive care unit (ICU) and extubated after 48 hrs.

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Case 2
43 years hypothyroid female, weighing 65 kg, underwent arthroscopic rotator cuff repair for right supraspinatus calcific tendinitis. The surgery lasted 5 hrs and total irrigation fluid used was 60 L. At the end of the procedure, patient was found to have bilateral stony hard chest with swelling of neck and face. Patient was kept in propped up position and ventilated. After 2 hrs, the swelling became soft and fluctuant. The patient was extubated after the recovery of a safe cuff leak with ETT cuff deflation. She was shifted to the ICU, monitored for 24 hrs with uneventful postoperative course. Chest X-ray showed oedema of subcutaneous tissue [Figure 1], which was managed conservatively.

Case 3
53 years hypertensive and diabetic male, weighing 90 kg with predicted difficult airway, underwent subacromial arthroscopic rotator cuff repair of right shoulder. Surgery lasted 4 hrs and irrigation fluid used was 60 L. At the end of surgery, an extensive woody swelling was noticed in the right shoulder, infrACLavicular, neck and face region. In anticipation of possible airway compromise, the patient was electively ventilated and managed in the ICU. The patient was nursed in propped up position and swelling resolved by the next day. Extubation and remaining postoperative course was uneventful.

DISCUSSION
Shoulder arthroscopy, in comparison to open techniques cause less postoperative pain and more rapid rehabilitation. Risk factors associated with upper airway compromise are protracted duration of procedure, arthroscopy in subacromial space (potential space with no encapsulation), increased pump pressure, large volume of irrigation fluid used, lateral decubitus position and obesity.[3]

The duration of surgery is directly related with complex pathologies and the surgeon’s experience.[3] Burkhart et al., correlated surgical factors for immediate postoperative weight gain. Mean arthroscopy fluid used was 30±24 L (mean±SD, range 6-115.5 L), intravenous fluid used was 1885±547 ml and surgical time of 91.2±45 min (mean±SD). No complications were seen in these patients. Minimizing amount of fluid extravasation, measured as weight gain, may minimize potential complications.[8] An increase in the surgical time may increase the volume of irrigation fluid used and hence risk of oedema of tissue planes.[4]

Preserving portals, fewer capsular rents, use of longer cannulas instead of threaded portals, reduce fluid extravasation. Minimizing overall fluid inflow is critical. A low continuous outflow provides a conduit for fluid to exit the subacromial space or joint rather than dissecting into soft tissue planes. Pump driven (controlled pump pressure of 40-80mmHg) rather than gravity inflow system provides better control of intraoperative bleeding. Direct control of flow rate and pressure by the surgeon, by remote control/foot pedal, reduces fluid extravasation.[7]

The choice of anaesthetic technique coupled with specific patient position has a direct effect on the complications in shoulder arthroscopy. In patients under general anaesthesia, extravasation of air contributed by use of a power shaver with suction in upright position resulted in extensive subcutaneous emphysema, pneumo mediastinum and tension pneumothorax.[6] In cases under general anaesthesia and interscalene block, tracheal obstruction was possibly related to loose soft tissues caused by senile changes, excess irrigating fluids or gravity.[4,5] Regional anaesthesia (RA) with interscalene or supraclavicular block is used in cooperative patients and short procedures. In comparison with GA, RA has less postoperative nausea and vomiting, reduces postoperative analgesic requirement and shortens hospital stay. In all the reported cases of life threatening airway oedema where interscalene block was used, surgical interruption and emergent intubation was required.[1,3] Fluid accumulation in submucosal tissue can obscure visualization of laryngeal structures, resulting in difficult and unsuccessful intubation.
Airway compromise under RA, identified early by patient’s verbal warning (neck pressure, difficulty in swallowing, shortness of breath) can alert the necessity of emergency intubation and ventilation. The use of GA with endotracheal intubation prevents the intraoperative development of acute airway obstruction.[13]

Arthrodebridement causes significant bleeding in inflamed tissue. Adjunctive techniques and devices are necessary to enhance visualization. This is achieved directly by controlling bleeders with thermal electrocautery devices or locally infused vasoconstrictors (1:300,000 of epinephrine saline irrigation) and indirectly by hypotensive anaesthesia or raising the pressure of irrigation fluid. Unlike RA, blood pressure manipulation is amenable under GA. Morrison et al. demonstrated achievement of safe and clear operative field with pressure difference of 49 mmHg between systolic blood pressure and pressure measured within the sub acromial space.[10] Relative hypotensive anaesthesia in selected patients (adequate cerebral perfusion to be ensured), improves surgical visualization and reduces fluid extravasation into periarticular subcutaneous tissues.[10]

The lateral decubitus position (LDP) and beach chair position (BCP) each offer unique benefits to the surgeon with respect to visualization and ease of surgery.[11] In LDP, Hynson et al. Postulated gravitational influence as a cause for complete airway obstruction.[12] LDP is associated with potential for peripheral neuropraxia, brachial plexopathy, direct nerve injury and airway compromise. The BCP has been associated with cervical neuropraxia, pneumothorax, air embolism and potential end organ hypoperfusion injuries. The evidence regarding the efficiency, efficacy and risks of LDP or BCP does not show any one position to be superior.[10]

In our cases, the irrigation fluid was pump and flow regulated. With anticipated long procedure, all patients had general anaesthesia and underwent surgery in lateral decubitus position (surgeon’s preference). Airway compromise was possibly related to the excessive use of irrigation fluid secondary to prolonged surgery. The recognition of increased swelling and notifying the surgeon to restrict fluids was not feasible, as the patient was accessible only after removal of the drapes at the end of surgery. The extensive cervicothoracic oedema can limit neck mobility and impair visualization of glottis, making reintubation difficult. Clinical suspicion of the airway oedema and vigilant monitoring resulted in prompt intervention. Supporting literature is lacking for any beneficial role of steroids or diuretics in this condition. Monitoring airway pressures/compliances and neck circumference (pre and postoperative), absence of cuff leak with endotracheal cuff deflation, airway edema on direct laryngoscopy/fibreoptic bronchoscopy, ultrasound observation of tissue fluid infiltration are some of the means of measuring tracheal compression.[13,14] Chest X-ray and lateral cervical X-ray can show enlargement of soft tissue including retrotracheal space.[5] Delaying extubation and postoperative observation in a controlled environment is required as extravasation may take 12 hrs to reabsorb.[5] Attention to operative detail (prolonged procedure, extensive debridement or extracapsular maneuvers), and careful post-operative monitoring can minimize the morbidity associated with these complications.

CONCLUSION

Complications in shoulder arthroscopy may be prevented by restricting surgical time, using deliberate hypotensive anaesthesia in selected patients, minimizing arthroscopic pump pressures and limiting amount of irrigation fluid. Informed consent should include anticipated postoperative airway complications. Regardless of position, longer cases should be performed under general anaesthesia so that adequate control over airway is ensured. High degree of clinical suspicion of airway oedema is required in the early postoperative period. Vigilant monitoring during intraoperative and postoperative period, with necessary equipment in hand and timely intervention, may prevent life threatening complications.

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