

Rheumatoid arthritis and anaesthesia

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Rheumatoid arthritis (RA) is an autoimmune disease that causes joint stiffness and pain. Life expectancy of patients with RA is reduced and the aetiology is unknown. Multi-organ system involvement is common, and the perioperative assessment is important. Joints involved that are crucial for the anaesthesiologist are temporomandibular joint (TMJ), cervical spine and cricoarytenoid.

Early involvement of the cervical spine in RA is common, and a majority are asymptomatic. The most common cervical spine disorder is atlantoaxial subluxation (AAS). RA can affect the TMJ with decreased mouth opening and cervical stiffness that can lead to a difficult airway. Involvement of the cricoarytenoid joint can be acute or chronic.

Systemic features of RA may be more prominent than articular manifestations. Heart failure is the most common cause of mortality; however, pulmonary fibrosis and valvular involvement have been described.

Serum rheumatoid factor (80%), HLA-DR4 subtypes (70%) and anti-citrullinated protein antibody are elevated in patients with RA. Other factors like female gender and family history may play an additional role.

The main goal of therapy is to relieve symptoms and long-term prevention of joint destruction and systemic involvement. Corticosteroids alleviate the pain, swelling and structural progression. Nonsteroidal anti-inflammatory drugs (NSAIDs) also provide effective symptom relief for RA. Early use of disease-modifying anti-rheumatic drugs (DMARDs) is recommended. Methotrexate (MTX) is the cornerstone for RA treatment and tumour necrosis factor (TNF) blockers reduce inflammation.

Preoperative assessment is crucial to evaluate the disease severity and drug therapy side-effects. RA can result in a wide range of airway involvement; therefore, preoperative airway assessment is imperative. The investigations necessary depend on the degree of organ involvement. Anaesthetic choice will be dictated by the type of operation and the patient. Orthopaedic surgeries are the most common procedures in patients with RA, and most regional anaesthetic methods may be applied. General anaesthesia has the advantage of maintaining respiratory and haemodynamic stability, however, airway manipulation and maintenance are crucial in patients with RA. In the postoperative period, precautions should be exercised during emergence with appropriate patient positioning and prevention of excessive neck movement.

Keywords: anaesthesia, rheumatoid arthritis, cervical spine, disease-modifying anti-rheumatic drugs, perioperative management

Rheumatoid arthritis and anaesthesia

Rheumatoid arthritis (RA) is an autoimmune, chronic inflammatory disease that causes joint stiffness, immobility, pain and erosion.¹ The aetiology of RA is unknown; however, it is appreciated that the life expectancy of patients with the disease is reduced compared with the general population.² Joints that are mostly affected are hands and wrists symmetrically; however neck, shoulders, hips, knees, feet and elbows can be involved.¹ RA and its treatment therapy may affect multiple organ systems beyond the joints, careful patient evaluation is crucial prior to elective surgery to assess complications that may impact fitness for surgery such as cardiovascular, pulmonary, hepatic and haematological abnormalities.³

Clinical features of rheumatoid arthritis

General features

Symmetrical joint pain, swelling, morning stiffness, weight loss and tiredness are some of the general clinical features of RA.⁴

Articular features

The most common joints affected by RA include neck, fingers, wrists, shoulders, elbows, hips, knees, ankle and feet.⁴ Moreover the spine and temporomandibular joints (TMJ) may be damaged by RA, and these joints play a crucial role during anaesthetic airway management.² Cricoarytenoid involvement tends to be overlooked by clinicians due to other severe complications of RA, however, it can affect 26–86% of patients.⁵

Cervical spine

Early involvement of the cervical spine is quite common in RA, ranging between 17–86% within five years after diagnosis.⁶ A majority of patients are asymptomatic, however, 40–85% of patients may present with a painful neck that is associated with features of radiological instability.⁷

There are three types of cervical spine disorders associated with RA: atlantoaxial subluxation (AAS), vertical subluxation and subaxial subluxation. The most common cervical spinal disorder

among these is the AAS which accounts for about two-thirds of the patients with RA.^{4,8}

The atlantoaxial joint is commonly affected due to disruption of the transverse ligament and erosion of odontoid peg, and this can lead to about 25% of patients who suffer from RA having axial instability.⁴

Atlantoaxial subluxation (AAS) consists of four types:

Anterior subluxation – affects 80% of patients (subluxation occurs when the distance between the atlas and odontoid peg is more than 3 mm, and is worse on flexion).

Posterior subluxation – affects 5% of patients (occurs with destruction of odontoid peg and backward movement of C1 on C2, and is worsened by extension).

Vertical subluxation – affects 10–20% of RA patients (this is secondary to destruction of C1 lateral mass and subluxation of odontoid peg through foramen magnum).

Lateral subluxation – is secondary to C1/C2 facet joint degeneration.^{4,9}

Subaxial subluxation is not common and occurs below C2, patients present with nerve compression symptoms earlier than AAS.⁴

Temporomandibular joint

RA can affect the TMJ secondary to upper and lower articular surface fibrosis.² This results in decreased mouth opening and cervical stiffness that can lead to both difficult head positioning and intubation.⁷

Cricoarytenoid joint

Involvement of the cricoarytenoid joint can be acute or chronic. Acute presentation includes upper airway obstruction, hoarseness of voice and dyspnoea. However, the chronic presentation can be asymptomatic or complicated by stridor and dyspnoea.⁵

Extra-articular features

RA can affect almost any organ in the body, and systemic features may be more prominent than articular manifestations.¹ The greatest cause of mortality in RA patients is cardiovascular disease, accounting for 50% of deaths.² Heart failure is the most common cause of mortality, however, carditis and valvular involvement has been described.⁷ Pulmonary fibrosis secondary to RA may cause restrictive disorders with reduction in forced vital capacity and forced expiratory volumes.^{1,2} The use of nonsteroidal anti-inflammatory drugs (NSAIDs) and cyclosporins can lead to gastrointestinal tract and kidney damage.⁷ Organ systems that are affected by RA and are of relevance to anaesthesiologist are illustrated in Table 1.⁴

Table 1: Extra-articular effects of RA

Organ system	Effects
Cardiovascular	<ul style="list-style-type: none"> • Pericardial effusions, pericarditis • Myocarditis, valve disease, left ventricular failure • Atherosclerosis and coronary heart disease • Peripheral vasculitis • Raynaud's phenomenon • Prothrombotic state
Respiratory	<ul style="list-style-type: none"> • Restrictive defect (fibrosing alveolitis and costochondral disease) • Rheumatoid nodules • Pleural effusions
Haematological	<ul style="list-style-type: none"> • Normocytic normochromic anaemia • Iron deficiency anaemia • Bone marrow depression
Hepatic and renal	<ul style="list-style-type: none"> • Decreased albumin
Neurological	<ul style="list-style-type: none"> • Peripheral neuropathy • Autonomic dysfunction

Diagnosis

The main cause of RA is not known, however, there are several contributing factors described. Patients with RA have high serum rheumatoid factor (80%) and HLA-DR4 subtypes (70%). Elevated anti-citrullinated protein antibody (ACPA) is also included for RA diagnosis with specificity of > 90%. Other factors like female gender, family history and cigarette smoking may play an additional role.^{4,10}

Management of RA

The main goal of therapy is to relieve symptoms of the underlying inflammatory process and the long-term prevention of joint destruction and systemic involvement.¹⁰

Symptom relief

Infection rates are relatively higher in patients with RA compared to the general population due to the use of immunosuppressant drugs. The risk of infection or delayed wound healing must be balanced with the benefits from use of immunosuppressant treatment to relieve RA symptoms.³

Systemic corticosteroids alleviate pain, swelling and structural progression of the disease, while intra-articular steroid injections relieve local inflammation.¹¹ Davis and Matteson¹⁰ individualises the initial dosage of corticosteroids based on metabolic factors, disease activity and patient risk factors to develop infection; and low-dose prednisone (5–10 mg/day) sustained for two years is recommended to relieve symptoms.

NSAIDs are also effective symptom relief treatment for RA patients; they can be used for short duration after gastrointestinal and cardiovascular risk assessment for side-effects has been done.¹² Gastric irritation and upper gastrointestinal bleeding are the common side-effects of NSAIDs, and coxibs use reduces the prevalence of haemorrhage.¹

Disease modification

Early use of disease-modifying anti-rheumatic drugs (DMARDs) in patients at risk of persistent arthritis is recommended to achieve clinical remission and prevention of long-term disability. Introduction of DMARDs within three months after onset of symptoms has shown good outcomes.¹²

Methotrexate (MTX) is a non-biological DMARD, the cornerstone for RA treatment unless contraindicated. It has good efficacy in early disease and it is more practical both in monotherapy and in combination with other drugs like corticosteroids.^{3,11} Therapy with MTX can be initiated at a dose of 15 mg/week along with folic acid to reduce mucosal, gastrointestinal and liver toxicity.¹⁰ There is limited and conflicting data regarding other non-biological DMARDs (leflunomide, hydrochloroquine, azathioprine, sulfasalazine), and treatment requires a multi-disciplinary discussion.³

Tumour necrosis factor (TNF) blockers are also used in association with MXT or in MXT-naïve patients. The use of TNF blockers reduces inflammation and disease progression; however, there is an increased risk of getting opportunistic infections and it is also costly when compared with other combination drugs used with MXT.^{12,13}

Anaesthetic management

Preoperative assessment

RA patients may present for surgery not related to the disease or for orthopaedic surgery as part of their treatment. It has been shown that over 25% of patients with RA undergo orthopaedic surgery within 10 to 20 years after diagnosis.^{4,6} Preoperative assessment including history and examination is crucial to evaluate the severity of the disease, target organ damage and drug therapy side effects to minimise surgery and anaesthetic complications.¹

The majority of patients with RA have articular changes that may affect the conduct of anaesthesia including patient positioning, airway management and mode of anaesthesia.^{1,6,7} Organ involvement should be assessed thoroughly; active cardiac conditions, pulmonary injury and haematological abnormalities must be optimised.^{3,7}

Evaluation of RA treatment during preoperative period is important to assess the extent of side-effects, and to weigh the risk of infection against the risk of disease flare. Corticosteroids are commonly used for RA treatment, and the well-known side-effects of the treatment are immunosuppression and Cushing's syndrome. Balancing between the risk of infection and adrenal insufficiency is crucial. Reduction or discontinuation of corticosteroids dose in the preoperative period has not proven to decrease the risk of side-effects perioperatively.^{2,3,7,14} Stress dose requirements depend on ACTH stimulation test, and the type of surgery usually dictates the dose required. If required, hydrocortisone 50–75 mg or methylprednisolone 10–15 mg intravenously is used on the day of the procedure.^{3,14,15}

MXT is frequently used in patients with RA, perioperative continuation of treatment is recommended due to low risk of infection associated with the drug.^{3,16} Krause and Matteson³ reported that there were no infections in the patients who continued or discontinued the TNF blockers.

Airway assessment

RA can result in a wide range of airway involvement; therefore, preoperative airway assessment is imperative. Common airway-related pathological changes caused by RA are AAS, TMJ ankylosis and cricoarytenoid arthritis.^{3,7} About 40–80% of patients with RA can develop neck pain and AAS instability, however, the absence of symptoms preoperatively does not assure safety during airway manipulation.^{1,17}

Kwek et al.⁹ advocate for all patients with RA to have a preoperative screening X-ray for cervical spine instability, and this should include frontal 'open mouth' odontoid and flexion and extension stress views. Recognition of cervical spine instability will alter airway management and prevention of further complications like hyperflexion or extension of the neck.¹ Figure 1⁴ shows the presence of AAS – it is present if the distance between odontoid peg and atlas is over 4 mm in patients older than 44 years and 3 mm in younger patients.⁴

Presence of TMJ ankylosis poses a risk of decreased mouth opening and difficult intubation. The use of the Mallampati score and mandible protrusion is recommended to assess the airway and severity.⁷

Approximately 80% of patients with RA have laryngeal involvement, preoperative nasoendoscopy is recommended to visualise cricoarytenoid and vocal cord dysfunction during inspiration.^{5,7}

Investigations

The degree of organ involvement will determine the preoperative investigations necessary in patients with RA, however, most cases will require a full blood count, urea and electrolyte, chest X-ray and ECG.⁴ Echocardiography and cardiac catheterisation



Figure 1: (A) Neck extension, and (B) Neck flexion. Note the position of dens axis (arrow). There is a dislocation between the dens and the main body of the axis.

may be indicated for patients with cardiovascular symptoms or risk factors.⁷

Patients with lung injury secondary to RA or DMARDs may require further investigations to assess the extent of damage, and this may include lung function tests and arterial blood gas analysis.^{4,7}

Intraoperative management

The choice or technique of anaesthetic will be dictated by the type of operation and general condition of the patient; currently there is no single standard technique.^{1,2} RA causes joint deformity and this may compromise the positioning of the patient, cause difficulty in insertion of invasive lines or regional anaesthesia, and restriction of airway manipulation and surgery.^{1,4,7} The risk of infection may be increased in some of the patients taking corticosteroids and DMARDs; therefore, aseptic technique during insertion of intravenous lines, urine catheters and regional procedures is crucial.^{4,11}

Choice of anaesthetic technique

Orthopaedic surgeries are the most common procedures performed in patients with RA, and most regional anaesthetic methods may be applied.¹ Regional or local anaesthetic technique avoids manipulation of the airway, provides effective postoperative analgesia and facilitates early ambulation.^{2,4,7} Surgeries of the lower limbs usually require spinal anaesthetic with or without opioids. Epidural can be inserted with the benefit of continuous postoperative analgesia through a catheter.^{1,7} For upper limb surgery, brachial plexus anaesthetic block can be used for analgesia and to provide prolonged operating time if a catheter is inserted.^{4,7}

The challenge with regional anaesthesia is the presence of deformities that can affect the positioning during surgery and access for regional techniques. Indwelling regional catheters and their care may also pose a risk of infection in patients taking immunosuppressants.¹ However, the most common contraindications for the use of regional techniques are patient refusal, use of anticoagulant therapy, infection at the puncture site, and haemodynamic instability.⁷

The use of inhalational, total intravenous or balanced general anaesthesia has the advantage of maintaining respiratory and haemodynamic stability. General anaesthetic is also useful for long procedures or for patients placed in uncomfortable operating positions.^{1,2,7}

Airway manipulation and maintenance are crucial aspects of general anaesthesia in patients with RA.⁷ Identification of patients at risk of airway complications prevents worsening and possible permanent airway damage.^{1,7} Maintenance of airway during general anaesthetic can be managed in several ways depending on the type of surgery and patient target organ involvement.⁴

Laryngeal masks may be required for several reasons in RA patients under general anaesthesia, such as to maintain airway during surgery and to allow the use of fibre-optic bronchoscopy while ventilating the patient.² Difficult insertion may occur if there is limited mouth opening, and a reinforced laryngeal mask may be preferred.⁴

When intubation is considered necessary, the presence and extent of cervical spine instability and laryngeal involvement should be identified to avoid further injury.^{1,2} Positioning of the head and neck before induction is important;^{1,2,4,9} in patients without or mild to moderate AAS, protrusion position with a flat pillow and doughnut-shaped pillow on top reduced anterior atlantodental intervals (ADI) and posterior atlantodental intervals (PADI) during laryngoscopy and intubation.^{1,7}

In the case of advanced AAS and TMJ ankylosis, mouth opening can be limited and minimal flexion or extension of the neck can cause neurological complications or death; therefore, awake fibre-optic intubation is recommended if general anaesthesia is deemed necessary.^{1,4,6,18} Involvement of the cricoarytenoids will warrant the use of smaller than normal endotracheal tubes or avoidance of intubation if severe,⁵ tracheostomy under local anaesthetic is therefore recommended.⁴

Postoperative care

In the postoperative period, precautions should be exercised during emergence with appropriate patient positioning and prevention of excessive neck movements.⁴ RA patients are sensitive to drugs and pulmonary complications; and depending on patient's risk factors, a high dependency unit may be necessary.^{2,4}

Postoperative use of opioids should be titrated and patient-controlled analgesia can be difficult to operate with severe arthritis of the hands.^{2,4} Risk of respiratory failure should be avoided with the use of physiotherapy and early mobilisation.^{2,4} Monitoring of renal function is important especially in patients at risk preoperatively. Corticosteroids and ulcer prophylaxis should be commenced whenever possible in high-risk patients.²

Conclusion

Rheumatoid arthritis is a complex multi-organ disease that requires multidisciplinary involvement in the perioperative period.² The disease poses a large number of challenges for the anaesthesiologist; comprehensive preoperative assessment is crucial, especially of the airway and organ systems. Anaesthetic technique should be tailored according to the individual patient needs and surgery; the postoperative period is as crucial with the same patient considerations as before the surgery.

Conflict of interest

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