

Original Article

Disease activity in rheumatoid arthritis as a predictor of difficult intubation?

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Summary

Background and objectives: Rheumatoid arthritis is a lifelong systemic disease that can affect any joint with a synovium. Managing intubation in patients with rheumatoid disease is a special challenge in these patients especially if specific joints, which play an important role during intubation, are affected. We aimed to investigate if there was a correlation between the activity and duration of the disease and the commonly used predictors of difficult intubation in rheumatoid arthritis. **Methods:** Sixty-six patients with the diagnosis of rheumatoid arthritis and 60 control patients were included in the study. Patient characteristics were recorded. Body mass index, disease activity scores, Mallampati classification, sternomental distance, thyromental distance, inter-incisor distance and atlanto-occipital joint extension were measured for each patient. Every patient was asked to complete the Stanford Health Assessment Questionnaire (HAQ score). Disease activity score (DAS 28 score) including 28 joints was used to assess the activity of the disease. Correlation between the predictors of difficult intubation and activity was assessed and was compared with the control group. **Results:** Mallampati scores were higher ($P = 0.000$), sternomental distance ($P = 0.005$) and inter-incisor distance ($P = 0.003$) were shorter and also occlusal surface–upper teeth angle ($P = 0.000$) and mouth corner–tragus line angle were smaller in the rheumatoid arthritis group compared with controls ($P = 0.000$). We did not observe a correlation between the disease activity scores and the Mallampati score ($P = 0.619$), sternomental distance ($P = 0.195$), thyromental distance ($P = 0.174$), inter-incisor distance ($P = 0.764$), angle I ($P = 0.372$) and angle II ($P = 0.609$). There was no correlation between the HAQ score and the Mallampati score ($P = 0.872$), sternomental distance ($P = 0.455$), thyromental distance ($P = 0.841$), inter-incisor distance ($P = 0.162$), angle I ($P = 0.768$) and angle II ($P = 0.287$). There was no correlation between the duration of the disease and the Mallampati score ($P = 0.619$), sternomental distance ($P = 0.505$), thyromental distance ($P = 0.426$), inter-incisor distance ($P = 0.813$), angle I ($P = 0.377$) and angle II ($P = 0.600$). **Conclusion:** Tests of disease activity and the duration of the disease were not found to be correlated with the predictors of difficult intubation in this study. Thus, performing the predictive tests for difficult intubation especially in patients with very low scores or short disease is recommended.

Keywords: INTUBATION INTRATRACHEAL; RHEUMATOID ARTHRITIS.

Introduction

Rheumatoid arthritis (RA) is a systemic autoimmune, inflammatory disease that is primarily manifested in

the synovium. Any joint with a synovium can be affected in the course of the disease. Involvement of the atlantoaxial joint, temporomandibular joint and cricoarytenoid joint causes special difficulties during intubation in this population. But these joints are usually expected to be affected in persistent disease with a long duration. It is expected to see difficult intubation in these patients and managing intubation in patients with rheumatoid diseases is a special

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challenge [1–3] because chronic inflammatory activity leads to multiple pathological alterations. Nevertheless, it has not been shown if there is a correlation between the duration or activity of the disease and prediction of difficult intubation. Difficult intubation can be expected with long-term disease based on the literature showing the involvement of special joints in the early stages of the disease with no symptoms [4]. We aimed to examine the correlation between the activity and duration of the disease and the commonly used predictors of difficult intubation.

Methods

A total of 66 patients who were admitted to the physical therapy department with the diagnosis of RA and 60 control patients were included in the study. Patients gave their informed consent and the local Ethics Committee approved the protocol. All of the patients with RA were diagnosed according to the American College of Rheumatology classification criteria for RA [5]. Physical examination, medical history of patients and blood biochemistry were evaluated in both groups to exclude systemic diseases such as diabetes mellitus and systemic lupus erythematosus. Height and weight were directly measured by using a standardized protocol. Body mass index (BMI) was calculated by dividing weight in kilograms by the square of the height in metres. We excluded patients with diseases known to affect bone metabolism such as hyperthyroidism, hyperparathyroidism and osteomalacia. Patients with a history of alcohol consumption and smoking were excluded.

Patients were asked to complete the Stanford Health Assessment Questionnaire (HAQ) to measure their functional capacity [6]. The HAQ includes questions about the ability of the patients with respect to dressing and grooming, rising, eating, walking, hygiene, reaching, grip and making activities. For example they were asked if they could dress themselves including shoelaces and buttons. The answers were categorized as: without any difficulties, with some difficulty, with much difficulty and unable to do so. The answers were scored as 0, 1, 2 and 3, respectively. The total score was then divided by 8 and the final score was calculated. They were also asked about their overall health, morning stiffness, their medical conditions in the past 6 months and pain severity.

Disease activity was assessed according to disease activity score in 28 joints (DAS 28). Components of DAS 28 are erythrocyte sedimentation rate (ESR), patient-assessed global score (PGA) (0–100), and swollen (SJC) and tender joint counts (TJC) (both 0–28). This score was calculated as previously

described [7] with the formulation

$$\text{DAS 28} = 0.56 \times (\text{TJC}) + 0.28 \times (\text{SJC}) + 0.7 \times \ln(\text{ESR}) + 0.014 \times \text{PGA (mm)}.$$

High activity of disease was defined as a DAS 28 > 5.1, moderate activity of disease was defined as between 3.2 and 5.1 and low activity of disease was defined as ≤ 3.2 [4]. C-reactive protein (mg dL^{-1}) was determined by the nephelometric method and ESR (mm h^{-1}) was determined by the Westergren method. Rheumatoid factor (RF, IU mL^{-1}) was determined by the nephelometric method [8] and RF > 20 IU mL^{-1} was defined as positive. All patients were then referred to the department of anaesthesiology. In order to predict difficult intubation the Mallampati classification, sternomental distance (SMD), thyromental distance (TMD), inter-incisor distance and atlanto-occipital joint (AO) extension were measured.

The Mallampati classification correlates tongue size to pharyngeal size and was performed in a standard fashion [9]. The sterno-mental distance was measured as the distance from the suprasternal notch to the mentum with the head fully extended and the mouth closed. A value of less than 12 cm has been found to predict a difficult intubation [10]. TMD was defined as the distance from the mentum to the thyroid notch with the patient's neck fully extended [11]. This measurement helps in determining how readily the laryngeal axis will fall in line with the pharyngeal axis when the AO joint is extended. Alignment of these two axes is difficult if the TMD is <3 finger breadths or <6 cm in adults; 6–6.5 cm is less difficult, while >6.5 cm is normal.

The inter-incisor distance was measured as the distance between the upper and lower incisors. Normal is 4.6 cm or more, while >3.8 cm predicts a difficult airway. AO joint extension assesses feasibility to adopt the sniffing position for intubation (alignment of oral, pharyngeal and laryngeal axes into an arbitrary straight line [12]). Two angles were measured in order to assess the AO joint extension. First, the patient was asked to hold the head erect, facing directly to the front. They were then asked to extend the head maximally and the examiner measured the angle traversed by the occlusal surface of upper teeth (angle I) using a goniometer. Any reduction in extension was expressed in grades: Grade I: >35°, Grade II: 22–34°, Grade III: 12–21°, Grade IV: <12°. Second, the patient was asked to lie in the supine position with no pillow under the head and to extend the head maximally. Then the angle between the mouth corner–tragus line and the horizontal line was measured (angle II). When the angle is <80° difficult intubation is expected.

Statistical analysis was performed with Pearson's correlation test and independent variables *t*-test.

Results

The patient group included 66 subjects (14 male; 52 female) and the control group included 60 subjects (12 male; 48 female). Mean age was 46.54 (24–78) in the RA group and 44.50 (26–86) in the control group ($P = 0.184$). Mean BMI was 22.73 (14.30–35.60) in the control group, while it was 25.64 (16–39) in the RA group ($P = 0.966$). Mean DAS 28 score was 4.437 ± 0.999 , HAQ score 1.380 ± 1.220 and the mean duration of the disease was 7.277 ± 5.705 yr.

Mean Mallampati score was 1.71 (1–3) in the control group and 2.5 (1–4) in the RA group ($P = 0.000$). SMD was 17.00 (14–19.5) cm in the control group and 16.20 (10.5–19.0) cm in the RA group ($P = 0.005$). TMD was measured as 7.75 (5.50–11.5) cm in the control group and 8.19 (6.00–11.5) cm in the RA group ($P = 0.040$). Inter-incisor distance was 5.57 (5–6.5) cm in the control group and 5.30 (3.5–7) cm in the RA group ($P = 0.003$). The mean value of angle I was 35.53° (28–39°) in the control group and 31.5° (15–40°) in the RA group ($P = 0.000$). Angle II was 88.1° (75–103°) in the control group and 79.15° (55–95°) in the RA group ($P = 0.000$) (Fig. 1).

We did not observe any correlation between the DAS 28 (4.437 ± 0.999 (mean $\pm$ SD) in the RA group) and the Mallampati score ($P = 0.619$), SMD ($P = 0.195$), TMD ($P = 0.174$), inter-incisor distance ($P = 0.764$), angle I ($P = 0.372$) and angle II ($P = 0.609$). There was no correlation between the duration of the disease (7.277 ± 5.705 (mean $\pm$ SD) in the RA group) and the Mallampati score ($P = 0.619$), SMD ($P = 0.505$), TMD ($P = 0.426$), inter-incisor distance ($P = 0.813$), angle I ($P = 0.377$) and angle II

($P = 0.600$). We also were unable to find a correlation between the HAQ score (1.38 ± 1.22 (mean $\pm$ SD) in the RA group) and the Mallampati score ($P = 0.872$), SMD ($P = 0.455$), TMD ($P = 0.841$), inter-incisor distance ($P = 0.162$), angle I ($P = 0.768$) and angle II ($P = 0.287$).

Discussion

RA is a systemic autoimmune, inflammatory disease that is primarily manifested in the synovium. Hands, wrists and feet are affected initially in the disease but any joint that is lined by synovia can be affected later in the progress of the disease. Knees, ankles, hips, elbows and shoulders are the most commonly affected joints.

Although it mainly affects the joints, extra-articular involvement is seen in almost all patients. Although there have been significant advances in therapy, there is still no curative method of treatment. Current treatment strategies aim to achieve clinical remission in order to prevent the long-term consequences of RA. Several composite indices are available to assess remission. All of them include joint counts in the assessment of the major organ involvement, but some employ reduced joint counts, such as the 28-joint count, which excludes ankles and feet [13].

The disease activity score including 28 joints (DAS 28) is used to assess the disease activity. Its simplicity as a mere joint count or in the context of DAS has also led to acceptance in several contemporary trials [13,14]. The Stanford Health Assessment Questionnaire measures patient-reported outcomes and provides intrinsic knowledge about a patient's health, functional status, symptoms and treatment preferences. HAQ, which was introduced in 1980, is based on five patient-counted dimensions: disability, pain, medication effects, costs of care and mortality [6].

Respiratory events are the most common anaesthetic-related injuries, following dental damage. The three main causes of respiratory-related injuries are inadequate ventilation, oesophageal intubation and difficult tracheal intubation [15]. Difficult tracheal intubation accounts for 17% of the respiratory-related injuries and results in significant morbidity and mortality. In fact, up to 28% of all anaesthesia-related deaths are secondary to the inability to mask ventilate or intubate.

Managing intubation in patients with rheumatic diseases is a special challenge [1–3] because chronic inflammatory activity leads to multiple pathological alterations. Cervical spine involvement occurs in the majority of patients with persistent disease for more than 10 yr [16]. But it has been shown that

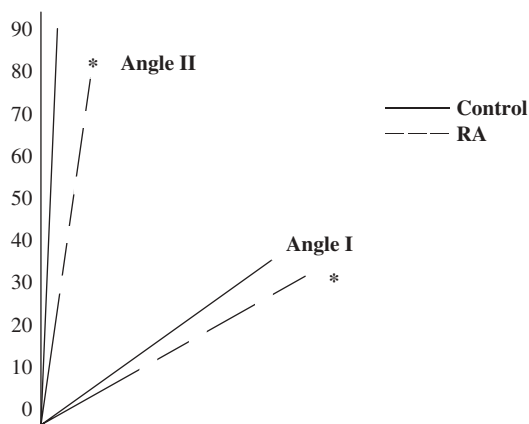


Figure 1.
Mean values of angle I and angle II in the rheumatoid arthritis (RA) and control groups.

involvement of special joints such as the temporomandibular joint could occur even in the early stages of the disease in patients with no symptoms [4]. The involvement of the atlantoaxial joint, temporomandibular joint and cricoarytenoid joints cause special difficulties during intubation. Possible reasons are the decreased range of motion of the cervical spine and the mandibular joint leading to a reduced opening of the mouth and reduced dorsal extension of the cervical spine. Furthermore, there is the problem of compression of the spinal cord in patients with subaxial instability of the cervical spine during laryngoscopy [17,18]. Airway management is of special importance in the perioperative period. If regional anaesthesia techniques are not practicable, intubation of the trachea by direct laryngoscopy may be difficult or impossible. To avoid these complications, fibre-optic intubation should be performed [19,20].

Several tests predicting difficult intubation have been proposed. TMD, SMD, horizontal length of mandible, inter-incisor gap (IIG) and Mallampati tests are the most commonly used, reliable and easy tests in this area [21]. The sensitivity, specificity and positive predictive values of TMD, modified mallampati grade and IIG when performed together have been reported to be 84.6%, 94.6% and 35.5%, respectively, in the normal population [21]. One limitation of this study is that it did not include RA patients undergoing surgery; thus the relation between the disease activity and actual difficult intubation could not be considered. But to perform such a prospective study with that many patients longer time is needed and the literature research has shown only few cases but no serial trials about management of difficult intubation in these patients [1–3]. As these patients are candidates for surgical interventions, these data from this study will be helpful in the future study.

As can be expected, we found that Mallampati scores were higher, SMD and inter-incisor distance were shorter and occlusal surface–upper teeth angle and mouth corner–tragus line angle were smaller in the RA group compared with controls. These results were possibly due to joint involvements in the patient group. The difference was statistically significant for each parameter between the RA and control groups. Yet, in our literature research we could not find a study investigating the correlation between these parameters and the disease activity and duration. We found several studies concerning difficult intubation in different patient groups or nations but we did not observe a study concerning difficult intubation in specific disease groups [22–24].

We did not find a correlation between disease activity, duration and the predictor tests of difficult

intubation, meaning that difficult intubation should be considered even in patients with early stage disease or inactive disease. It should always be kept in mind that temporomandibular and atlantoaxial joints, which are important during intubation, could be affected in early disease without any other joint involvement. Because the DAS 28 score assesses all joints, it can be high due to other joint involvements or can be low due to only temporomandibular or atlantoaxial joint involvement in patients in whom other joints are not affected. Thus, relying only on these tests of disease activity and not performing the predictive tests for difficult intubation especially in patients with very low scores might result in missing the important joint involvements and cause unexpected difficult intubation. In conclusion, we believe that predictive tests of difficult intubation should be performed in every patient with RA even if the disease activity scores are low or the disease is newly diagnosed.

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