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**Case Report**

# Robotic intraoperative tracheal repair during retrosternal malignant goiter excision: an anesthetic challenge

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## ABSTRACT

Thyroidectomy is the treatment of choice for large retrosternal goiters. These tumors often are large enough to require thoracotomy. Robotic surgery can help in avoiding thoracotomy and its associated post operative complications. Rarely, such tumors and their surgery can be complicated by tracheal tears. Such tears, especially those near the carina are difficult to repair and often require open thoracotomy. We described such a case where we avoided open thoracotomy and instead performed a minimally invasive robotic repair of tracheal tear. The maintenance of ventilation during this robotic repair was critical. A combination of several airway devices was used to allow the complex surgical repair to be executed without affecting ventilation.

**Keywords:** Robotic surgery, Tracheal repair, Retrosternal goiter, Cook's airway

## INTRODUCTION

Robotic surgery is now increasingly being used for thyroidectomy. The role is even greater in large retrosternal goiters where they can avert the need for thoracotomy. Large retrosternal goiters and their surgery can rarely get complicated with tracheal tears.[1] Tracheal tears, especially those near the carina, are difficult to treat and require open thoracotomy leading to significant risk of infections and other forms of postoperative morbidity.[2] We described such a case who developed a tracheal tear intraoperatively. Due to the experience of the surgical team and the age and comorbidities of the patient, we executed a robotic intraoperative tracheal repair. The anesthetic challenges faced maintain ventilation during this procedure are discussed in this case report.

## CASE REPORT

A 72-year-old woman came to surgical oncology OPD with complaints of swelling in right side of neck for 20 years with difficulty in swallowing and occasional breathlessness. The patient was investigated and diagnosed to have follicular neoplasm of right thyroid lobe. Patient was a known hypertensive with hypothyroidism which were well controlled with calcium channel blockers and thyroxine. On physical examination patient was of average built and all organ system functions were within normal limits. All the lab values were within normal limits. The computed tomography scan of neck showed a large 70×70×90 mm right thyroid mass with retrosternal extension which was causing both luminal narrowing and left deviation of the trachea.

Patient was planned for robotic right hemithyroidectomy with robotic cervical and mediastinal approach.

Before induction of anesthesia, patient was premedicated with 2 µg/ml of fentanyl, 0.2 mg glycopyrrolate and 8 mg dexamethasone. General anesthesia was induced with 2 mg/kg propofol and 0.6 mg/kg rocuronium. The patient was intubated using a left sided double lumen tube (Rush DLT, Duluth GA, USA) to achieve one lung ventilation. The right lung was completely deflated to provide adequate space for the robotic arms in the mediastinum. Robotic right hemithyroidectomy was then performed successfully by the surgical team. After the conclusion of the surgery, an intercostal drainage tube (ICD) was inserted on the right side and the patient was shifted to two-lung ventilation. There was no visible air leak on the ICD. Hence, the anesthesia was reversed smoothly and the patient was extubated. Around 10 minutes post-extubation, air leakage from the ICD was observed. Fibre-optic bronchoscopy was performed to identify the source of air leakage. On fibre-optic bronchoscopy a rent in the right tracheal wall located around 2.5 cm away from the carina was observed. A flexometallic tube was inserted and positioned in such a way that its balloon on inflation, sealed the tracheal rent. The ventilation was provided carefully by using low tidal volumes and high FiO2, a careful watch was kept to detect any episodes of desaturation.

A robotic repair of tracheal rent was planned. This repair would include passing of a silicon stent over the tracheal lumen followed by surgical repair of the rent using a mucosal flap.

**Figure 1: Layout of robotic thoracoscopic port placement for tracheal repair**

In order for providing space for the robotic arms, an Arndt occluder was passed through the flexometallic tube and positioned so as to occlude the right main bronchus. Once the right lung was deflated, the robotic arms were introduced into the thorax (Figure 1). Once the arms were in position to introduce the silicon stent, the flexometallic tube was retracted proximally. The silicone stent was then introduced into the tracheal lumen through the tracheal rent by the robotic arm. Immediately after this, a Cook's airway was introduced coaxially through the flexometallic tube. The flexometallic tube was then removed and a microlaryngeal tube was rail-roaded over the Cook's airway. The Cook's airway was then withdrawn. The robotic surgical repair of the tracheal rent was performed and a mucosal flap was used to provide support to the repaired area. After this repair was completed, the patient was then shifted to the ICU on mechanical ventilation. After 24 hours, the patient was extubated. There was no air leakage from the ICD which was later removed. The patient made an uneventful recovery.

## DISCUSSION

Tracheal tears involving the distal trachea are rare complications generally seen after trauma such as stab injury or gunshot wounds. Iatrogenic causes for tracheal injury or tear is often reported in airway instrumentations, diagnostic transbronchial procedures and therapeutic airway interventions. They can also complicate head and neck, thyroid, and esophageal surgeries. Thyroidectomies are common surgeries with low surgical risks, performed for malignant and non-malignant indications. Tracheal injuries are rare post-thyroidectomy, they usually occur near the ligament of Berry where blood vessels are suture ligated or diathermy is used for haemostasis. However, large retrosternal goiters can lead to distal tracheal involvement.

The traditional approach to repair of distal tracheal perforations requires open thoracotomy. This procedure is associated with increased risk of postoperative respiratory complications and has a long recovery period with significant impairment of quality of life. Robotic and thoracoscopic approach to repair of tracheal perforations reduces cardiorespiratory complications and improves quality of life.[3]

The anesthetic approach to patients undergoing tracheal repair is challenging. This challenge is further magnified in cases where robotic approach is being employed as adequate ventilation has to be ensured while simultaneously providing enough space to deploy robotic arms in the mediastinum. Extracorporeal membrane oxygenation (ECMO) is often employed in such cases where ventilation is challenging.[4]

Robotic repair of tracheal tears has been reported in only a handful of cases. Marano et al reported a case of esophageal squamous cell carcinoma who while undergoing a robot-assisted hybrid 3-stage esophagectomy with lymphadenectomy after chemoradiotherapy. Intraoperatively, the patient developed tracheobronchial tears due to adhesions between the esophagus and the respiratory tract. A robotic repair of these tears was performed successfully.[5] Melinte et al reported a 54-year-old female patient who developed a tracheal tear after a surgery for an L5-S1 disc herniation. In view of the experience of the surgical team, robotically assisted approach was used to successfully repair the lesion.[6] Brito et al performed a robotic assisted

repair of a tracheal tear which had occurred as a complication of mechanical ventilation in an elderly lady who had developed severe COVID-19. They used ECMO to maintain oxygenation during the procedure.[4]

Robotic surgery is increasingly being used for thyroid surgeries.[7,8] Specifically, large retrosternal goiters which often require thoracotomy are suited for robotic approach as there is no need for open thoracotomy. However, we did not come across any case report of robotic repair of tracheal tear following retrosternal goiter surgery. Probably we have reported the first such case.

In our case, considering the old age and comorbidities of the patient, open thoracotomy would have led to considerable morbidity and delay in recovery. Considering the expertise of the surgical team in robotic surgery, we offered this approach to the kin of the patient who readily agreed for this minimally invasive approach.

The anesthetic challenge of ensuring adequate ventilation during the repair process was dealt with by the ingenious use of a combination of airway devices including a flexomettalic tube, an Arndt occluder, Cook's airway and finally microlaryngeal tube. Careful monitoring of the ventilation status enabled us to maintain the ventilation while allowing the surgeons to perform the robotic repair.

## CONCLUSION

In conclusion, tracheal tears are a rare complication of thyroidectomy. These injuries, specifically those in the distal part of the trachea near to the carina can be challenging to repair. Both the surgical aspects as well the anesthetic aspects in terms of maintaining ventilation are critical. Such patients, as far as possible should be treated in a centre with expertise in the management of such complications, While, open thoracotomy repair is reasonable for most centre, if expertise is available robotic repair is effective and safe alternative which reduces the post-operative morbidity. The anesthetic management of a robotic repair represents another challenge. A carefully designed strategy to maintain ventilation is essential for a successful outcome in such cases.

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