

Rare delayed tracheal perforation after total thyroidectomy repaired with autologous pericardial patch

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e-ISSN 2797-457X
DOI: 10.52830/inajcc.v1i1.100

Received: October 24th, 2024
Accepted: February 15th, 2025

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Abstract

Background: Thyroidectomy is a general surgical procedure that is very common with 3–5% complication rate. Tracheal perforation after thyroidectomy is rare at 0.06%, and is usually identified and repaired intraoperatively. Delayed tracheal perforation is even rarer, with only few cases reports with different management.

Case illustration: A 57-year-old female underwent total thyroidectomy for infiltrating bilateral thyroid cancer. Tumor infiltration to the trachea was shaved, followed by tracheostomy to secure the airway. Perforation symptoms appear on day 4 after the patient experienced choking in the form of progressive sputum production. Perforation was found in the shaven area fused to the tracheostomy hole sized 2x3 cm. The patient was managed in stages, initially with debridement and antibiotics followed by surgical repair. Tracheal repair surgery performed an autologous pericardial patch combined with a PTFE vascular implant. The patient was extubated 1 week after repair and discharged alive. No further complications on follow-up.

Discussion: In this case, perforation happened due to mechanical force on the remaining thin shaved tracheal wall during choking. Autologous pericardial patch was used due to its several advantages combined with PTFE vascular implant as rigid stenting that prevent collapse when breathing.

Conclusion: Autologous pericardial patch combined with PTFE was sufficient to close delayed perforated trachea after thyroidectomy.

Keywords: Autologous Pericardial Patch, Delayed tracheal perforation, Total thyroidectomy

Abstrak

Latar Belakang: Tiroidektomi merupakan prosedur bedah umum yang cukup sering dilakukan, dengan tingkat komplikasi sekitar 3–5%. Perforasi trachea pasca-tiroidektomi merupakan komplikasi langka dengan insidensi sekitar 0,06% dan biasanya dapat diidentifikasi serta diperbaiki selama operasi berlangsung. Perforasi trachea yang muncul secara terlambat merupakan kondisi yang jauh lebih jarang, dengan hanya sedikit laporan kasus dan variasi dalam penatalaksanaannya.

Ilustrasi Kasus: Perempuan berusia 57 tahun menjalani tiroidektomi total akibat kanker tiroid bilateral dengan infiltrasi ke trachea. Dilakukan *shaving* pada infiltrasi tumor pada dinding trachea, kemudian dilakukan tracheostomi untuk menjaga jalan napas. Gejala perforasi muncul pada hari ke-4 pascaoperasi setelah pasien mengalami tersedak disertai peningkatan produksi sputum progresif. Perforasi ditemukan pada area *shaving* yang berfusi dengan lubang tracheostomi berukuran 2x3 cm. Pasien ditata laksana secara bertahap, dimulai dengan *debridement* dan pemberian antibiotik, kemudian dilanjutkan dengan pembedahan perbaikan. Rekonstruksi trachea dilakukan menggunakan *autologous pericardial patch* yang dikombinasikan dengan implan vaskular PTFE. Pasien berhasil diekstubasi satu minggu setelah operasi dan dipulangkan dalam kondisi baik tanpa komplikasi lanjutan pada tindak lanjut.

Diskusi: Pada kasus ini, perforasi terjadi akibat gaya mekanik pada dinding trachea yang menipis akibat *shaving* selama episode tersedak. Penggunaan *autologous pericardial patch* dipilih karena memiliki beberapa keunggulan biokompatibilitas, sedangkan implan vaskular PTFE digunakan sebagai penopang yang kaku untuk mencegah kolaps trachea selama respirasi.

Kesimpulan: Kombinasi *autologous pericardial patch* dan implan PTFE terbukti efektif untuk menutup perforasi trachea yang timbul terlambat pasca-tiroidektomi.

Kata Kunci: Autologous pericardial patch, perforasi trachea tertunda, tiroidektomi total

Background

Total thyroidectomy is frequently performed for various indications, including benign multinodular goiter and thyroid cancer. It is a safe procedure with 3–5% complication rate. Several common complications including hypoparathyroidism, recurrent laryngeal nerve injury, and, less commonly, tracheal injury.^{1–3} Tracheal perforation after thyroidectomy is rare ranging at 0.06% - 0.5%, and is usually identified and repaired intraoperatively. It can lead to significant morbidity if not recognized and managed promptly.⁴ Several factors contribute to the risk of delayed tracheal perforation. These include extensive surgical dissection, especially in cases involving large goiters or malignancies that may adhere to the trachea, and the use of diathermy, which can cause thermal injury to surrounding tissues. Additionally, patients with a history of neck radiotherapy may have increased susceptibility to tracheal injury due to fibrosis and altered tissue integrity.^{5–7}

Delayed tracheal perforation following total thyroidectomy is even rarer but particularly concerning due to the potential for airway compromise and the need for urgent intervention critical complication.^{8,9} While immediate tracheal injuries are more commonly recognized, delayed perforations can occur days to weeks postoperatively, often complicating the clinical picture of the patient.

Symptoms of delayed perforation can include subcutaneous emphysema, respiratory distress, and pneumomediastinum, which may manifest several days postoperatively.^{9,10} The clinical presentation may be subtle initially, with patients experiencing mild symptoms that can progress to severe respiratory compromise if not addressed. Diagnosis typically involves imaging studies, such as CT scans, which can reveal air leakage or direct visualization of the perforation.¹¹

Management strategies typically involve securing the airway, which may require intubation or tracheostomy, followed by surgical repair of the tracheal defect if feasible.^{4,12} The timing of intervention is crucial; early recognition and management can significantly improve outcomes, while delays can lead to severe complications, including prolonged ventilation or the need for more extensive surgical repairs.^{8,10}

To date there is only few publications presenting delayed tracheal perforation after total thyroidectomy with very limited option of surgical technique for repair.

Case Illustration

We report a case of a 57-year-old female complaining mass on the neck for 30 years. The lump grew progressively for 3 months. Patient also complained about hoarseness for 3 weeks. CT scans show inhomogeneous hypodense mass with intralesional calcification in both thyroid lobes, especially on the left. There was also enlargement on the bilateral neck lymph nodes.

The patient underwent surgery for total thyroidectomy. Intraoperatively tumor infiltrated the trachea in the second ring on the left side. We performed tumor shaving with scalpel leaving a thin and soft tracheal wall. Tracheostomy was performed to secure airway. The patient observed in the ICU without any problems and on the third day moved to the regular room.

Day 4 after the operation, there was a lot of slem seepage from tracheostomy wound after the patient experienced choking. Due to massive increased slem production, explorations were carried out. We found tracheal perforation on the shaven area fused to the tracheostomy hole sized 2x3 cm. Given dirty and contaminated wounds, we decided to perform only debridement, and the tracheostomy was replaced with an endotracheal tube. The patient was readmitted to the ICU and given broad spectrum antibiotic.

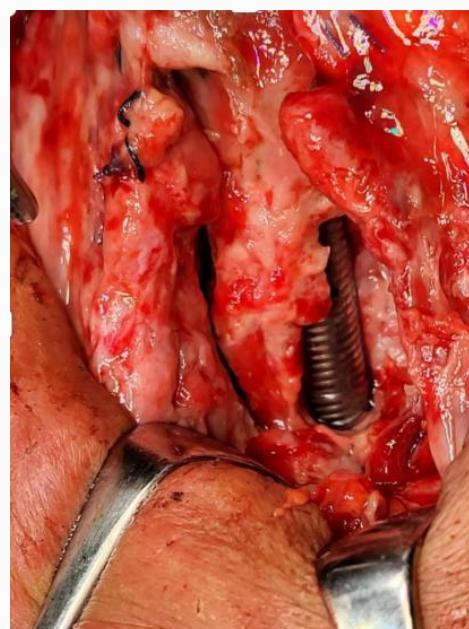


Figure 1. Perforated trachea on the shaven area fused to tracheostomy hole. Tracheostomy tube was removed and replaced with an endotracheal tube.

Day 7 patient underwent tracheal repair surgery using autologous pericardial patch combined with PTFE vascular implant. The patient was extubated 1 week after repair and discharged alive. There was no further complication on the follow-up visit. Patient can talk normally without any hoarseness. Postoperative histopathology examination showed a papillary thyroid carcinoma with anaplastic component.

Discussion

Thyroidectomy is commonly performed worldwide. It is a safe procedure with rate of complications less than 3%–5%.¹³ With only few cases reported globally, delayed tracheal perforation without an intraoperative tracheal injury is an uncommon complication. It has been reported that 4–27 days after thyroidectomy, tracheal perforation still exists. The risk factors include female sex and toxic thyroid nodules, especially large nodules and compress the trachea for a long time, weakening the cartilaginous wall of trachea. Tracheal perforation risk factors also include prolonged high doses of steroids prior to surgery, prior radiation therapy, high pressure during the procedure, suction tube damage to the trachea, and disruption of blood flow during the coagulation process with an electrocautery device. Coughing repeatedly or getting infections due to blood clots can also become risk factors after surgery.^{14,15}

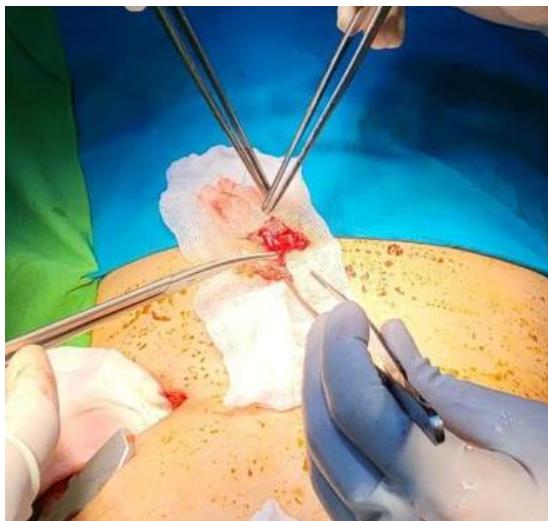


Figure 2. Autologous pericardial patch was harvested through “mini thoracotomy” procedure. An 8 cm incision was made on the anterior of left fifth intercostal.

In this particular case, the thyroid mass was large and already compress tracheal for about 30 years. The trachea was also infiltrated by the cancer that made the operation became more challenging. The

incidence of coughing on the day 4 was suspected as a trigger of the perforation. Perforation occurs secondary to elevated subglottic pressure through a thin and weak portion of the trachea, following coughing where subglottic pressure is markedly elevated.¹⁴

The most common symptoms of delayed tracheal perforation are neck swelling and subcutaneous emphysema. In addition, there are also several cases of fever, coughing, hemoptysis, and respiratory distress reported.¹⁵

Our patient didn't experience any neck swelling or emphysema. The main symptom was massive slem production instead. The tracheostomy tube and the gap in the tracheostomy wound prevented emphysema, as well as the symptoms of dyspnea or respiratory distress. But it made it easier for infections to occur.

Our decision not to perform immediate perforation repair was appropriate. Considered the high contamination of the patient's wound, performing an immediate repair will increase the risk of failure and potentially lead to greater morbidity. We removed the tracheostomy tube and replaced it with an endotracheal tube to secure the airway. By cleaning the contamination, closing the wound and treating the infection, we prepared the optimal wound conditions for repair.



Figure 3. The trachea after repaired. Firstly, the defect repaired with autologous pericardial patch, the PTFE was placed over as a stent to support it from collapsing and prevent stenosis in the future. The PTFE is then covered again with the remaining pericard.

The degree of the patient's symptoms and the size of the tracheal defect determine how the defect is treated.¹⁶

Conservative measures like bed rest, low-dose steroid therapy, high-pressure oxygen supply, and antibiotics may be used in patients with minor defects and no or improving respiratory distress.¹⁷ Primary suturing is adequate if the defect is small and the inflammation is not severe. Muscle flaps can be used to reinforce non-circumferential defects and localized severe inflammation; tracheal resection and reconstruction or anastomosis may be required for circumferential defects that extend beyond half of the trachea.^{18,19}

The use of free autologous pericardial patches as tracheal substitutes has several benefits, including the ability to be used in surgical settings, ease of handling, flexibility, and customization to the specific needs of each case, lack of tissue rejection and foreign body reactions, and—above all—the ability to maintain an airtight seal of the reconstructed airway. Within months, mature granulation tissue replaces the free pericardial patches, which act as a scaffold for the reepithelialization of the respiratory mucosa to restore normal mucociliary flow to the larynx.^{20,21}

Long-term outcomes of pericardial patch tracheoplasty have shown promise, with studies indicating successful epithelialization and integration of the patch within months post-surgery. Respiratory epithelium covers the mesenchymal tissue of the pericardium. According to the postmortem study, the pericardial patch has been well-integrated into the surrounding trachea and cannot be identified in its original form. Throughout the repaired trachea, a full epithelium lining was seen, along with the development of normal mucosal and submucosal structures, including glands and vessels. The pericardial patch becomes well incorporated as early as three months.²²

The use of pericardial patch in tracheal reconstruction combined with stenting has been reported in several cases, which can be either internal or external stenting. This aims to prevent pericardial floating and stenosis.²¹ In this case we use PTFE vascular implant as a external stenting. PTFE is a Synthetic polymer that has been used in many surgical applications, especially in reconstructive and vascular surgery. Polytetrafluoroethylene (PTFE) has emerged as a significant material in the field of tracheal reconstruction due to its mechanical strength and durability, making it a suitable candidate for reinforcing tracheal repairs.

Conclusion

The combination of pericardial patches and polytetrafluoroethylene (PTFE) in tracheal repair represents a

promising approach to addressing tracheal defects particularly as a complication after thyroidectomy.

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