# Bronchial Thermoplasty
## A Nonpharmacologic Therapy for Severe Asthma

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**KEYWORDS**

• Bronchial thermoplasty • Asthma • Bronchoscopy • Airway smooth muscles

**KEY POINTS**

- Severe asthma accounts for substantial morbidity and increased health care use.
- Bronchial thermoplasty is a novel therapeutic modality that targets airway smooth muscles in patients with severe asthma and chronic airflow obstruction.
- Current evidence suggests that bronchial thermoplasty is effective in reducing asthma exacerbations and emergency department visits, and improving quality of life.
- Long-term studies have demonstrated that bronchial thermoplasty is safe and has sustained clinical benefits when used to treat patients with severe asthma.

## INTRODUCTION

Asthma is characterized by nonspecific airway hyperreactivity, and chronic inflammation and intermittent respiratory symptoms of breathlessness, wheeze, and cough triggered by infection, environmental allergens, or other stimuli. It affects more than 25 million people in the United States.[1] Asthma treatment aims at (1) reducing inflammation with inhaled corticosteroids (ICS), (2) relaxing airway smooth muscle (ASM) with inhaled bronchodilators, (3) minimizing exposure to allergic triggers, (4) modifying the allergic response, (5) addressing confounding comorbidities, such as anxiety, rhinosinusitis, vocal cord dysfunction, obesity, and gastroesophageal reflux disease, as well as smoking, and (6) patient education. Despite these measures, around 5% to 10% of patients will have persistent symptoms.[2,3] Unfortunately, such patients will have substantial morbidity and mortality and increased health care use, as well as decreased quality of life.[4]

According to the recent guidelines of European Respiratory Society and American Thoracic Society, severe asthma is defined as asthma that requires treatment with high-dose ICS as well as a second controller, including the possible use of systemic corticosteroids; symptoms can be either controlled or uncontrolled with such therapy.[2] It is important to recognize that severe asthma represents a heterogeneous group of multiple phenotypes and, thus, treatment is tailored according to the underlying pathophysiologic mechanism(s) contributing to such illness.[5] Omalizumab is a monoclonal antibody targeting IgE that might lead to better asthma control in patients with a predominant allergic phenotype.[6] Monoclonal antibodies against interleukin-5 have also shown

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substantial benefit in patients with the eosinophilic asthma phenotype, whereas antibodies against interleukin-4α and 13 have shown promise in patients with T2 allergic severe asthma phenotype.[6] Bronchial thermoplasty (BT) is a relatively new technique aiming at reducing ASM that potentially might lead to improving quality of life and reducing exacerbations in patients with severe asthma. This review focuses on BT and how clinicians could potentially select the appropriate patient for such treatment.

## BRONCHIAL THERMOPLASTY: ROLE IN SEVERE ASTHMA

Chronic airflow obstruction in severe asthma is probably due to increased airway wall thickness from airway remodeling caused by various mechanisms, such as epithelial thickening, subepithelial fibrosis, smooth muscle hypertrophy, inflammatory cell infiltration, and goblet cell hyperplasia.[7,8] BT is a novel approach aiming to target ASMs in an attempt to help reverse airway remodeling. This aim is achieved by delivering controlled thermal radiofrequency (RF) energy to the airway walls causing a reduction in ASM contractility and quantity. Based on preclinical as well as large clinic trials, the US Food and Drug Administration approved BT for the treatment of severe persistent asthma in patients 18 years and older whose asthma is not well-controlled despite treatment with ICS and long-acting bronchodilators in April 2010.

## BRONCHIAL THERMOPLASTY DEVICE

BT is delivered by the Alair Bronchial Thermoplasty System (Boston Scientific, Natick, MA) and consists of a RF controller and a disposable catheter with an expandable 4-arm array at its distal tip inserted through the working channel (2 mm) of a bronchoscope and is marked at 5-mm increments (**Fig. 1**). The smaller diameter of the diagnostic bronchoscope is preferred over the larger therapeutic bronchoscope, allowing more thorough visualization and treatment of the distal tracheobronchial tree. The controller is used with a footswitch that initiates the delivery of RF thermal energy. The electrical energy (18 W) applied for 10 seconds and delivered through the electrodes is converted into heat (up to a prespecified temperature of 65°C) when met with tissue resistance. A return electrode is placed on the patient's back or thigh and connects to the RF controller, thereby completing the circuit. BT is delivered in a systematic fashion to airways located beyond the mainstem main bronchi and are on average 3 to 10 mm in diameter because airway resistance occurs in bronchi larger than 2 mm in diameter, causing airway constriction during asthma exacerbation.[9]

## BRONCHIAL THERMOPLASTY TECHNIQUE

BT should always be performed by an experienced bronchoscopist and is done in a series of 3 bronchoscopic sessions separated by at least 3 weeks, which allows shorter procedure times and decreases the risks associated with widespread irritation of the airways in patients with severe asthma. BT can be performed either under moderate sedation with benzodiazepine and opioids or under general anesthesia, depending on the preference of the bronchoscopist, anesthesiologist, and institution. Although there are no head-to-head studies comparing both types of anesthesia, at our institution we perform BT under general anesthesia with a laryngeal mask airway because it provides comfort (less coughing) with less desaturation during the procedure, which might impact the number of activations delivered. The first session targets the right lower lobe, the second

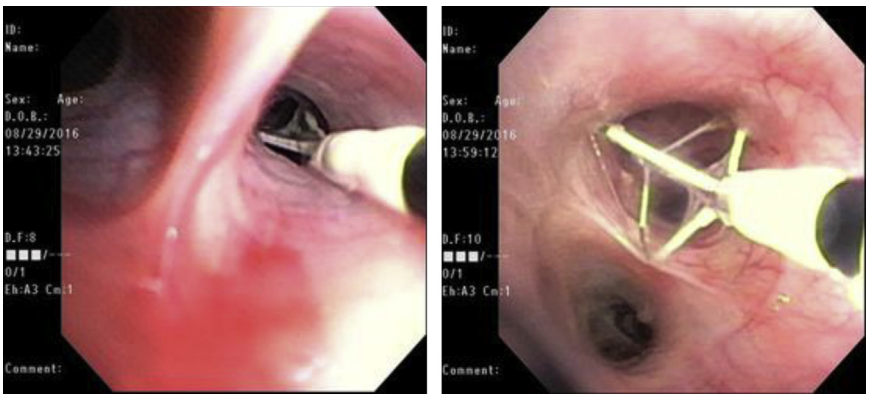


**Fig. 1.** The catheter is placed distally (*left*), electrode array expanded (*right*) and controller then activated.