

## Therapeutic effect of botulinum toxin A on folliculitis dissecans of the scalp

*Efeito terapêutico da toxina botulínica A em foliculite dissecante*

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### ABSTRACT

A patient with dissecting folliculitis of the scalp who did not respond to antibiotic therapy received four monthly sessions of intradermal administration of 100 IU of botulinum toxin A. Four months after treatment, a complete recovery of the affected area of the patient's scalp was observed. A biopsy taken from the affected area showed the presence of *Staphylococcus lugdunensis* and *Staphylococcus aureus* resistant to erythromycin. Botulinum toxin A had no effect on the viability or biofilm production of the *Staphylococcus* strains, indicating that the healing effect of the toxin was associated with the host response alone.

**Keywords:** Botulinum Toxins Type A; Folliculitis; Alopecia; *Staphylococcus aureus*; *Staphylococcus lugdunensis*.

### RESUMO

Um paciente com foliculite dissecante que não respondeu à terapia com antibióticos recebeu quatro sessões mensais de administração intradérmica de 100 UI de toxina botulínica A. Quatro meses após o tratamento, foi observada uma recuperação completa da área afetada do couro cabeludo do paciente. Uma biópsia da área lesionada mostrou a presença de *Staphylococcus lugdunensis* e *Staphylococcus aureus*, ambos resistentes a eritromicina. Observou-se que a toxina não teve efeito sobre a viabilidade ou produção de biofilme das cepas de *Staphylococcus*, indicando que o efeito curativo da toxina estava associado apenas à resposta do hospedeiro.

**Palavras-chave:** Toxinas Botulínicas Tipo A; Foliculite; Alopecia; *Staphylococcus aureus*; *Staphylococcus lugdunensis*.

## Case report

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## INTRODUCTION

Dissecting folliculitis of the scalp (DFS) is a rare cause of scarring alopecia characterized by neutrophilic inflammation, hair loss, perifollicular pustules, nodules, and abscesses.<sup>1</sup> Although these abscesses are sterile, they are frequently associated with secondary bacterial infection, mainly by *Staphylococcus aureus*.<sup>2</sup> The conventional treatment for this disorder involves the use of topical and oral antibiotics, which may not be very effective in severe cases, for which surgical removal of the lesions needs to be considered.<sup>3</sup> Therefore, there is an urgent need to find new treatments to control the development of DFS. Several studies have demonstrated the effectiveness of botulinum toxin A as an alternative treatment for nonscarring androgenetic alopecia, which is not associated with infection.<sup>4,5</sup> We report the case of a patient with DFS who showed complete resolution of the condition after treatment with botulin toxin A.

## CASE REPORT

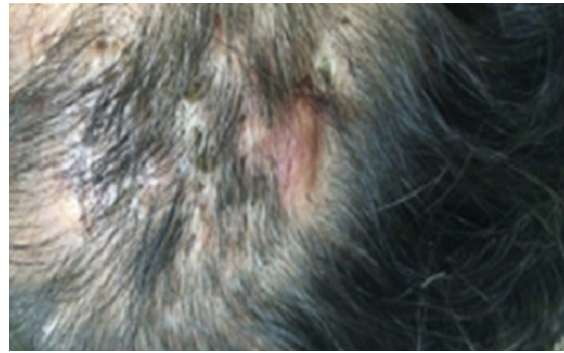
A 37-year-old man with clinical symptoms of DFS was admitted to our clinic. The patient did not have associated comorbidities such as high blood pressure, diabetes, or obesity. Clinical examination revealed the presence of nodules, abscesses, and a patch of hair loss (Figure 1).

At admission, the patient was treated with tetracycline antibiotics (100 mg/day for 12 weeks) and received intralesional administration of corticosteroids and antibiotics, but did not respond to these treatments. Botulinum toxin A was considered an alternative treatment option. The patient received intradermal administration of 100 IU of botulinum toxin A (Allergan) at days 0, 30, 60, and 90. A diagram of the scalp area to be treated was previously defined by outlining the infection sites. Each injection site received a dose of 2.5 IU/100 µL of botulinum toxin A in sterile saline 0.9%. The patient did not receive any other type of treatment during this period. After treatment, the patient reported resolution of pain within the first 2 weeks. Four months after the initial treatment, the abscesses and swelling subsided and a significant increase in hair density was observed (Figure 2).

For microbiological analysis of the affected area, a punch biopsy of approximately 3 mm in size of the patient's scalp was performed before treatment with botulinum toxin A.<sup>6-8</sup> The results showed the presence of *S. aureus* and *S. lugdunensis* resistant to erythromycin (Table 1).



**FIGURE 1:** Macroscopic analysis of the scalp before treatment with botulinum toxin A



**FIGURE 2:** Macroscopic analysis of the scalp after 4 months of treatment with botulinum toxin A

The effect of botulinum toxin A on the growth (bacteriostatic effect) and killing (bactericidal effect) of *S. aureus* and *S. lugdunensis* was also investigated, by measuring the optical density of the bacterial culture and counting the number of colony-forming units, respectively.<sup>9-11</sup> In addition, the effect of botulinum toxin A on biofilm formation by the bacterial strains was determined by colorimetric assay, as described by Sheikl et al.<sup>12</sup> The results showed that botulinum toxin A had no effect on the viability of the *Staphylococcus* strains and did not influence their ability to form biofilm (Table 2).

**TABLE 1:** Antimicrobial Profile of the *Staphylococcus* strains derived from the patient's scalp legional area

	Erythromycin	Tetracycline	Doxycycline
<i>Staphylococcus aureus</i>	R	S	S
<i>Staphylococcus lugdunensis</i>	R	S	S

R = Resistant

S = Sensitive

Table 2: Influence of botulinum toxin A on bacterial viability and biofilm formation

	PROLIFERATION O.D. 595 nm				CFU				BIOFILM O.D. 595 nm			
	Without Toxin		With Toxin		Without Toxin		With Toxin		Without Toxin		With Toxin	
	Mea	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Staphylococcus aureus</i>	0,652	0,03	0,660	0,03	2,65x10 <sup>8</sup>	0,04	2,73x10 <sup>8</sup>	0,05	0,45	0,05	0,50	0,008
<i>Staphylococcus lugdunensis</i>	0,592	0,05	0,600	0,04	9,8x10 <sup>7</sup>	0,009	9,67x10 <sup>7</sup>	0,05	1,98	0,04	2,00	0,04

The Table shows the mean  $\pm$  SD (Standard Deviation)

O.D.= Optical Density

CFU = Colony-forming Units

Obs: Positive for biofilm formation when the optical Density is higher than 0,5

## DISCUSSION

DFS is a rare skin disorder that can cause significant emotional distress due to the appearance of the affected skin, as well as itching, pain, and permanent hair loss. It destroys hair follicles by causing deep follicular occlusion, followed by follicular rupture and deep inflammation of the hair bulb. Therefore, DFS is categorized as a type of cicatricial folliculitis.<sup>13</sup> Although DCS is commonly associated with *S. aureus*, our report shows that *S. lugdunensis* can also be involved. In addition, our findings indicate that the healing effect of botulinum toxin A does not seem to be associated with the toxin's direct action on the pathogen, as it had no effect on the viability of the *Staphylococcus* strains found in the patient and on their ability to produce biofilm. In contrast, treatment with botulinum toxin A was highly successful, with the patient reporting resolution of pain within the first few days of treatment and full recovery after 4 months. Therefore, it seems that the healing effect of botulinum toxin A is associated with the host response. However, the mechanism of action of the botulinum toxin A remains unclear, as the toxin has the ability

to interact with both neuronal and immune cells.<sup>4</sup> Nevertheless, several studies have indicated that, under conditions of altered immune response induced by the cholinergic anti-inflammatory pathway and the release of calcitonin gene-related peptide, botulinum toxin A can act locally as an antagonist agent.<sup>4,14-17</sup> Therefore, it is possible that the intradermal administration of botulinum toxin A in patients with DCS can shift the patient's dysfunctional inflammatory reaction to a competent immune response and, as a consequence, restore the normal functioning of the affected area of the scalp. However, further research is needed to fully understand the mechanisms behind the healing effect of botulinum toxin A and to establish protocols to optimize its use as a therapeutic tool for DFS.

## CONCLUSION

Our findings suggest that botulinum toxin A is an effective alternative for the treatment of DFS in patients who do not respond to conventional treatment with antibiotics. ●

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