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Diagnosis and Management of Retrograde Cricopharyngeal Dysfunction: A Systematic Review

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Abstract

Objective. Retrograde cricopharyngeal dysfunction (R-CPD) is a syndrome with rapidly increasing awareness since being first described in March 2019. As such, few cases of R-CPD are currently reported in the literature. The goal of this study is to provide a comprehensive systematic review of the available literature on R-CPD, including patient characteristics, diagnosis, and management.

Data Sources. PubMed, Scopus, EMBASE.

Review Methods. A systematic review of the available English literature was conducted using the data sources PubMed, Scopus, and EMBASE. Studies with original data of patients experiencing classic symptoms of R-CPD were included. Independent abstract screening followed by full-text screening was performed to assess study eligibility. Data extraction of patient demographics, symptoms, treatment, and follow-up were subsequently performed.

Results. Common presentations of R-CPD include abelchia (100%), abdominal bloating (83%), and gurgling noises (75%). 554 (86.9%) patients had improved symptoms after initial treatment with BTX. The most common initial dose was 50 units in 204 (37.3%) patients. Subsequent BTX injections resolved symptoms in 40 (80%) patients. Six patients ultimately received CP myotomy for recurrent symptoms, resulting in long-term resolution in 4 (67%) patients.

Conclusion. R-CPD is a newly recognized syndrome with effective treatment options including botulinum toxin injections and cricopharyngeal myotomy, where appropriate. Diagnostic modalities including esophageal manometry may aid in the initial work up of R-CPD, however further studies are required to assess its diagnostic utility.

Keywords

abelchia, botulinum toxin, cricopharyngeal myotomy, retrograde cricopharyngeal dysfunction

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Retrograde cricopharyngeal dysfunction (R-CPD) is a syndrome characterized by the inability to belch, gurgling noises, excessive flatulence, and abdominal bloating. R-CPD is thought to be caused by the impaired relaxation or coordination of the cricopharyngeus (CP) muscle during swallowing, resulting in abelchia, or the inability to belch.[1] Although R-CPD was initially described in March 2019 by Bastian et al,[2] a rapid patient-driven awareness predated this publication. This was largely attributed to the growth of online forums on social media platforms including Reddit and TikTok. These have been used as an outlet for many patients who were left undiagnosed despite having undergone extensive diagnostic testing. The largest of these forums is hosted on the Reddit platform under a subreddit entitled "r/noburp." This community was created in 2014 and has quickly grown to include over 30,000 members.[3] These forums are dedicated to information-sharing and support; they include lists of specialists that treat R-CPD and stories of those who lived with abelchia and underwent treatment.

As there is no gold standard for diagnosis, R-CPD is a clinical diagnosis based on symptomatology and relief following botulinum toxin (BTX) injection of the CP muscle. Researchers at the Bastian Voice Institute in Illinois postulated that a BTX injection into the CP muscle could be both diagnostic and therapeutic for patients with the symptoms characteristic of R-CPD.[2] Diagnostic tools such as Fiberoptic Endoscopic Evaluation of Swallowing (FEES), manometry, and modified barium swallow studies are inconsistently

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utilized in R-CPD as they have unknown utility due to lack of dedicated research, although manometry boasts established efficacy in the workup of cricopharyngeal dysfunction (CPD).[4]

The most common treatment of R-CPD involves injection of botulinum toxin into the CP muscle. BTX injection is a widely accepted standard for the management of pathologies involving the CP muscle such as CPD.[5] It has been shown to induce muscle relaxation, thereby improving swallowing and also belching function.[5] BTX injection is minimally invasive, and its potential complications are usually temporary and well tolerated. The first in-office BTX injection was performed and described by Blitzer and Brin in 1993 as an alternative to surgery for the management of UES dysfunction.[6] If symptoms recur after an initial BTX injection, myotomy of the CP muscle or repeat BTX injections have been performed. However, due to the novelty of R-CPD, the use of BTX injection or myotomy of the CP muscle for R-CPD is less well established in this disorder.

Early identification and management of R-CPD can significantly improve patient quality of life. A major obstacle to R-CPD management is the limited literature, which is composed primarily of small case reports and series. Previous studies have suggested that BTX injection is adequate for the initial management of these patients. However, given the novelty of R-CPD and the infancy of its literature, the need for a high-power review on the efficacy of the available treatment options is apparent. We hypothesize that BTX injections and CP myotomy are effective initial and refractory treatment options, respectively, for R-CPD.

Methods

Inclusion Criteria

From the initial database searches, 77 unique articles were identified. Of the records screened, 52 were excluded based on irrelevance to the research question or being non-English or animal studies. Seventeen studies ultimately met the inclusion criteria (**Table 1**).[7–23] Articles that were included presented original findings pertaining to R-CPD diagnosis, treatment, and outcomes. Patients of all ages were included. Each article included was subjected to a bias assessment as described by the Agency for Healthcare Research and Quality (AHRQ).[24] The AHRQ bias assessment evaluates the following forms of bias: selection, performance, attrition, detection, and reporting. All 17 articles were included based on the results of the bias assessment.

Search Strategy

The Preferred Reporting Systems for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed for this systematic review.[25] According to the exemption criteria set forth by our institution, this review was exempt from Institutional Review Board approval. A systematic review of published peer-reviewed literature was conducted on July 8, 2024, to investigate our hypothesis. PubMed, Scopus, and EMBASE were searched from inception to the present. Search terms for PubMed, Scopus, and EMBASE included (retrograde AND cricopharyngeal AND dysfunction)/(retrograde AND cricopharyngeus AND dysfunction)/(upper AND esophageal AND dysfunction AND inability AND to AND belch). Of note, terminology to describe R-CPD has evolved, and certain terms, such as abelchia, were excluded from our search terms. No other filters or limits were applied to the other databases. References of accepted articles were queried to search for additional studies to include.

Eligibility Criteria

Report selection was performed by 2 authors (SZ and RM). The systematic review collaboration platform, Rayyan, was used to facilitate unbiased review of records.[26] Abstract screening was performed followed by full-text screening (**Figure 1**). 57 duplicate records were removed prior to review. If there was a discrepancy between the authors during review, a third author (HK) independently arbitrated the article's relevance to the research question. A study was included if it presented original data from patients diagnosed with R-CPD. Exclusion criteria at each stage are described in the PRISMA flow diagram (**Figure 1**). A bias assessment evaluated each article for selection bias, performance bias, attrition bias, detection bias, and reporting bias.

Data Extraction

Data collection was performed independently by 2 authors. Demographics, presenting symptoms, treatment characteristics, and postoperative short-term and long-term outcomes were recorded. Standard statistical formulae were used to calculate mean age. In the article by Oude et al, median age was reported.[12] Estimation of the mean from the median age, age range, and size of the sample was calculated using formulae described by Hozo et al.[27] Postoperative outcomes were determined by comparing preintervention and postintervention symptom profiles. These outcomes were variably reported among the literature. Postoperative resolution of symptoms was defined as patient-reported relief of preoperative symptoms.

Results

Patient Characteristics and Evaluation

637 patients (318 males, 319 females) with R-CPD were identified among the 17 studies included in the systematic review. The mean age among the patients was 29 years with a range of 7 to 68. These patients presented with a variety of symptoms associated with R-CPD including

Table 1. Summary of Selected Studies

Author	Year	Study	No. of patients	Initial Botulinum toxin units (U)	Follow-up	Success rate	Operative side effects/complications
Arnaert	2024	Prospective case series	50	75 U	Mean: 29 months	51%	Temporary dysphagia, throat pain, reflux
Bastian	2020	Case report	1	50 U	6 months	100%	None
Dorfman	2024	Retrospective case series	5	60–75 U	Mean: 5 months	100%	Transient dysphagia
Doruk	2023	Retrospective case series	67	In-office (IO) patients–30 U OR patients–80 U		IO: 65% OR: 90%	Transient dysphagia, regurgitation, hoarseness
Doruk	2024	Prospective cohort study	108	In-office patients–30 U OR patients–80 U	3 months	Not reported	Not reported
Hoesli	2020	Retrospective case series	200	165 patients–50 U 35 patients–75 U	6-52 months	80%	Cellulitis from pharyngeal mucosa tear, tooth pain, laryngospasm, pulmonary edema
Hoffman	2022	Retrospective case series	5	4 patients–50 U 1 patient–25 U	1.5-10 months	100%	None
Kahrilas	2022	Review article and case report	1	100 U	1.5 months	100%	Not reported
Karagama	2021	Retrospective case series	72	10 patients–50 U 5 patients–75U57 patients – 100 U	Not reported	96%	Transient regurgitation and dysphagia
Mitchell	2023	Case report	1	60 U	6 months	100%	None
Oude	2021	Case-control study	8	50 U	Not reported	88%	Transient dysphagia
Pavesi	2023	Case report	1	10 U	4 months	100%	None
Siddiqui	2022	Retrospective case series	85	Range: 25–100 U, mean 85 U	Not reported	88%	Transient dysphagia, reflux, regurgitation, and hiccups
Silver	2023	Retrospective case series	6	2 patients–50 U 1 patient–60 U 1 patient–75 U 2 patients– 100U	Not reported	Not reported	Not reported
Wajsberg	2021	Retrospective case series	18	13 patients–50 U 5 patients–75 U	6 months	56%	Transient shortness of breath, dysphonia, and dysphagia
Xie	2022	Case report	1	50 U	1 year	100%	None
Yousef	2024	Case-control study	8	Mean: 75.6 U	Mean: 7 months	75%	Transient dysphagia, regurgitation

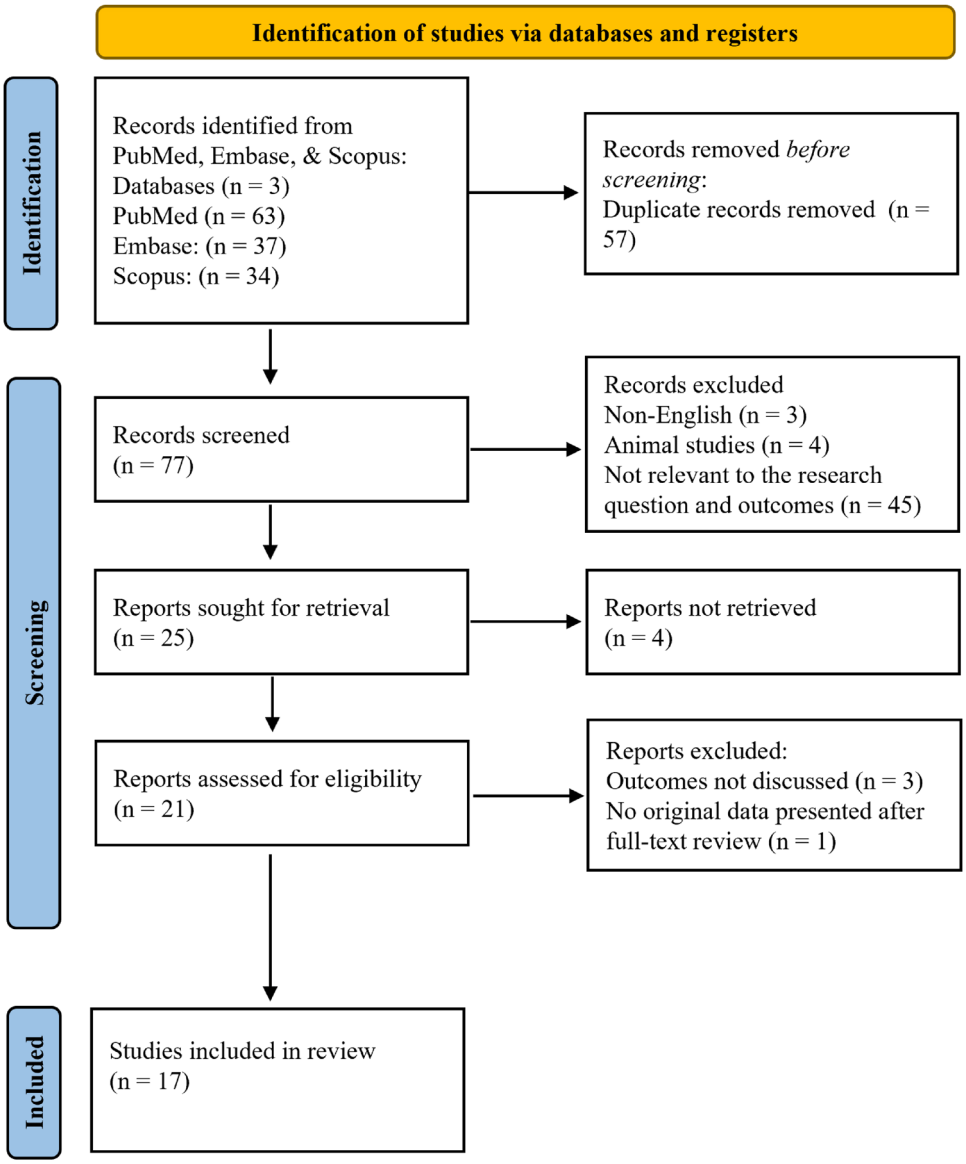

Figure 1. PRISMA flow diagram demonstrating the selection process for articles included in the systematic review.

inability to belch, gurgling noises, abdominal bloating, and excessive flatulence (**Table 2**).

The most common presenting symptoms included abelchia (100%), abdominal bloating (83%), and gurgling noises (75%). Many patients endorsed lifelong symptoms, some even receiving testimonials from their parents that they had difficulty burping as an infant. The 72 patients described in Karagama et al were excluded from the analysis of presenting symptoms as the patients presenting with symptoms other than abelchia were not quantified. Karagama et al did state that the majority experienced bloating, gurgling, and flatulence.[11]

Prior to their diagnosis of R-CPD, across the studies, 219 (34%) patients underwent diagnostic evaluation to assess any structural abnormality or functional deficit.

Table 2. Patient Demographics

	n (%)
Total	637
Age, mean [range]	29 [7-68]
Male	318 (50)
Female	319 (50)
Presenting Symptoms	
Inability to belch	637 (100)
Abdominal bloating	530 (83)
Gurgling noises	478 (75)
Excessive flatulence	454 (71)
Other[a]	88 (14)

[a]Other includes hiccups, dysphagia, globus sensation, throat tightness, difficulty vomiting, excessive vomiting, chest pain, nausea.

Among the patients with reported diagnostic evaluations, the most common modalities used were esophagogastroduodenoscopy (EGD) (n = 103, 47%), swallow studies (n = 61, 28%), high-resolution impedance manometry (HRIM) (n = 45, 21%), and laryngoscopy (n = 22, 10%). Less common modalities include CT scan (n = 14, 6%), colonoscopy (n = 2, 1%), hydrogen breath test (n = 1, <1%), and gastric emptying scan (n = 1, <1%). Trials of antireflux therapy (n = 99, 45%), antispasmodics (n = 2, 1%), and anxiolytics (n = 1, <1%) were attempted in some patients, but did not demonstrate improvement in symptoms.[7,8] On EGD, 1 study noted abnormal incidental findings of gastritis or esophagitis in 14 patients.[13] On laryngoscopy, abnormal incidental findings were seen in 2 patients and included a vocal cord polyp and incomplete glottic closure. Swallow studies, CT scan, colonoscopy, hydrogen breath test, and gastric emptying scan demonstrated no abnormalities. These diagnostic tests did not explain the constellation of R-CPD symptoms the patients were experiencing. Manometry demonstrated findings supportive of an R-CPD diagnosis, including reduced esophageal contractility, increased upper esophageal sphincter (UES) pressure, and absence of UES relaxation.

Management

All 637 patients were treated via botulinum toxin injection into the CP muscle. 7 of 17 studies disclosed using botulinum toxin A, representing 342/637 (54%) of patients. The remaining studies did not indicate the subtype of botulinum toxin used. No procedural complications were reported. One patient received a prior esophageal dilatation that was unsuccessful in achieving symptom relief; this patient later experienced relief after a single BTX injection.[13] 6 of these 637 patients also received a CP myotomy for recurrent symptoms post-injection. Botulinum toxin dosages for index injections ranged from 10 units to 100 units (**Figure 2**). Most patients (n = 204, 37.3%) received 50 units for the initial injection. Of note, Siddiqui et al and Yousef et al did not stratify patients by index dosage; however, the average index dose reported in each study was 85 units and 76 units, respectively.[13,23]

Three different methods of injection were reported across the studies. Most patients (n = 523, 79%) received BTX injections endoscopically under general anesthesia in which the CP muscle was visualized and injected. Several authors used an in-office, awake transcutaneous EMG-guided delivery method via either a direct or lateral approach[15,16,19,20,22] and 113 (20%) patients were injected with this method Another method of injection is reported in a case report in which a catheter balloon was inserted intranasally and used to identify the location of the CP muscle. Under ultrasound guidance, the CP muscle and balloon are identified, and an electromyography needle is inserted into the CP muscle.[16]

Outcomes

The literature revealed a spectrum of postoperative complication rates varying from studies reporting no complications to instances where most patients experienced complications.[10,14] Common postoperative complications included fever, mild swelling, mild regurgitation, and dysphagia. Several patients required antibiotic intervention for management, but all postoperative complications were transient. Complication rate did not vary by dosage of BTX given.

Across all studies, follow-ups were performed up to 4 years from the initial BTX treatment. 554 (87%) patients experienced improved symptoms after the initial BTX

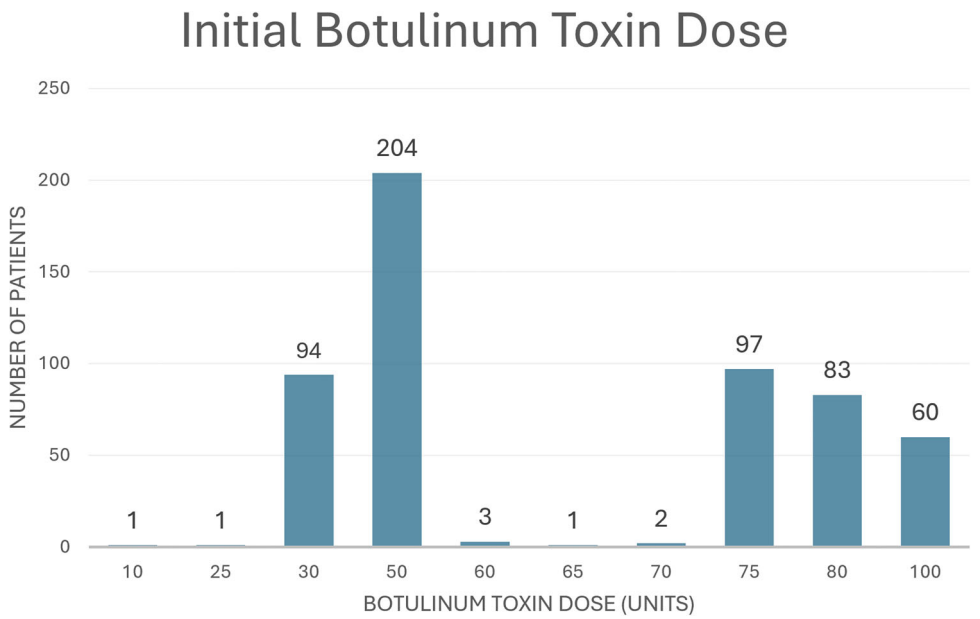

Figure 2. Initial botulinum toxin dose (units) injected into the cricopharyngeal muscle.

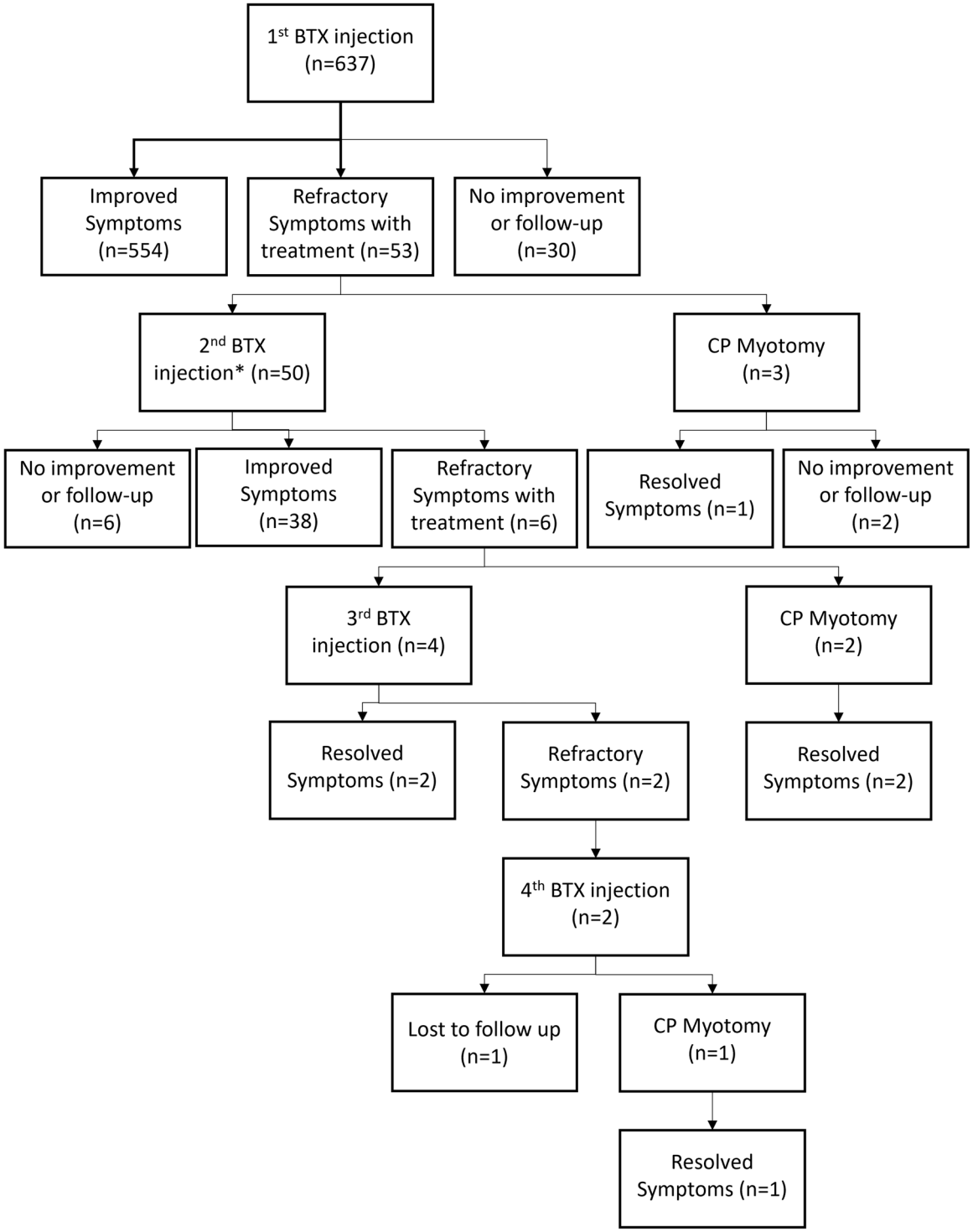

Figure 3. Symptom management following botulinum toxin (BTX) injection. BTX, botulinum toxin; CP, cricopharyngeal.

injection (**Figure 3**). 53 patients with symptoms refractory to their first BTX injection received additional treatment. Of note, the term refractory encompasses the term recurrent in our reporting as patients experienced an initial period of resolution followed by recurrence of symptoms. 38 (76%) patients experienced symptom resolution after 1 subsequent BTX injection, and 2 patients experienced resolution after 2 subsequent BTX injections. Six patients received a total or partial myotomy of the CP muscle, 3 of whom had 1 prior BTX injection, 2 of whom had 2 prior BTX injections, and 1 of whom had 4 prior BTX injections. Of all the patients treated for recurrent symptoms by BTX or myotomy, 44 (83%) experienced eventual long-term symptom improvement. Two patients had a balloon dilatation performed alongside their second botulinum

toxin injection, but both experienced refractory symptoms.[11] Four (67%) patients who received a myotomy experienced resolution of symptoms without need for further intervention (**Figure 3**). Of the 2 patients who received myotomy without long-term improvement, 1 was lost to follow-up, and the other experienced immediate relief with symptom recurrence over time.

Initial botulinum toxin dose in patients with refractory symptoms was recorded. Of the 53 patients with recurrent symptoms, initial dose was reported in 25 patients. The initial doses in these patients were 75 units (n = 7, 28%), 80 units (n = 6, 24%), 50 units (n = 5, 20%), 30 units (n = 3, 12%), 60 units (n = 2, 8%), and 100 units (n = 2, 8%). All patients received either the same or a higher dose on subsequent BTX injection(s).

Discussion

R-CPD is a syndrome that manifests as the inability to belch, gurgling noises, excessive flatulence, and abdominal bloating. Because of these symptoms, patients often experience social inhibition and embarrassment. The awareness of R-CPD has grown rapidly since the syndrome was first described by Bastian et al.[2] Between 2019 and 2020, all unique cases of R-CPD were published from the Bastian Voice Institute (BVI). Since then, the number of patients learning about R-CPD and seeking treatment has grown, and there were more published cases in 2024 (n = 171) than any year since the large case series published at the BVI in 2020 (n = 200).[8] Furthermore, the published studies include 2 prospective trials which further elevate our understanding of this disorder. Before the introduction of R-CPD, patients with abelchia would undergo various diagnostic tests including esophagoscopy, barium swallow studies, and esophageal manometry. Despite multiple evaluations, patients with R-CPD often remained undiagnosed, as there is no gold standard for diagnosis. Common alternative diagnoses after extensive work up included acid reflux, irritable bowel syndrome, or "stress." Treatment of these conditions did not demonstrate symptom relief.[2]

Among the diagnostic tests used, the most common tests were flexible laryngoscopy, EGD, swallow studies, and HRIM. No structural abnormalities that would explain the R-CPD symptom constellation were seen on laryngoscopy or gastrointestinal evaluation in any patients. Swallow studies and imaging likewise were insignificant in R-CPD patients. Several studies did report on the results of UES manometry supporting a diagnosis of R-CPD, although there is limited evidence to suggest its utility in the prediction of posttreatment failure. Common manometric characteristics were noted in preoperative R-CPD patients, including the absence of UES relaxation upon gastroesophageal reflux, air entrapment reflected by high impedance levels, and secondary peristalsis to clear air from the esophagus.[17,18,23] Involvement of the CP muscle was suggested by a significant reduction in UES basal pressure 3 months after BTX injection.[28] Interestingly, patients with refractory symptoms following initial BTX injection were noted to have higher rates of ineffective swallowing on manometry, and were more likely to have a diagnosis of ineffective esophageal motility or absent contractility.[23] These findings may support the use of UES manometry as an assessment tool for stratifying the risk of postoperative treatment failures, however further research is required.

Currently, initial R-CPD treatment has been primarily composed of BTX injection into the posterior portion of the CP muscle. BTX chemodenervation results in CP muscle relaxation, thereby improving swallowing and belching function for these patients.[5] Our review demonstrates that BTX dosages up to 100 units have a low risk of serious or permanent postoperative complications. The vast majority (>85%) of patients reported symptom relief after an initial BTX injection. Of the patients who continued to experience symptoms after an initial BTX injection, the majority received a second BTX injection, and a minority underwent CP myotomy. 80% of patients who received at least 1 subsequent BTX injection experienced long-term symptom resolution. Although a minority (<1%) of reported patients underwent myotomy, 67% of patients experienced complete symptom resolution regardless of how many prior BTX injections they had received with subsequent symptom recurrence. Several studies have indicated that myotomy may exhibit a higher success rate in treating CPD compared to BTX injections.[4]

Esophageal balloon dilatation was discussed in several studies as a potential alternative treatment for R-CPD. Upper esophageal sphincter dilation has demonstrated both safety and effectiveness in treating dysphagia due to CPD and has been noted to affect neuroplasticity, specifically to improve cortical projection and sensory input to brainstem central pattern generators.[29–31] In 1 article, esophageal dilation was performed prior to initial BTX injection in a patient with R-CPD but demonstrated no improvement in symptoms.[13] In a second study, esophageal dilatation was performed alongside a second BTX injection for recurrent symptoms in 2 patients but also failed to demonstrate long-term improvement.[11,13] Although current studies for dilation in R-CPD patients are not promising, further research into the utility of esophageal dilation is necessary, given the relatively low number of patients that received this treatment.

We found that complications following BTX injection for R-CPD included transient dysphagia and regurgitation, as well as increased reflux. Studies investigating BTX injection have reported similar side effects for its use in CPD, as well as in dysphonia and dystonia. These effects are noted to be transient with complete resolution in the immediate postinjection period.[28,32] No complications were noted after myotomy.

Between 10 and 100 units of BTX were initially injected, with the most common initial dose being 50 units in 204 (37.3%) patients. As seen in our findings, thankfully the

vast majority of patients have success with this initial BTX injection. For those with refractory symptoms following initial BTX injection, the most common initial dose was 75 units, followed by 80 units and 50 units. The reasons behind a subset of R-CPD patients exhibiting a suboptimal response to BTX injection remain unclear. This highlights the need for future clinical studies with the aim of characterizing patient factors such as symptom severity that may influence BTX efficacy in R-CPD management. These results demonstrate that BTX injection and CP myotomy are effective treatments for R-CPD. Further study is needed to determine effective initial and subsequent BTX injection doses, as well as when myotomy is indicated.

This review provides a comprehensive summary of the available literature pertaining to the efficacy of BTX injection and myotomy as management options for R-CPD. It is important to acknowledge the limitations of this review, including inconsistent follow-up periods, which may introduce bias in assessing the long-term efficacy of treatment. In addition, the mean age of reviewed patients was 29 years. This may reflect the recent popularity surrounding R-CPD on social media outlets such as TikTok and Reddit that are disproportionately used by younger people. Nevertheless, the success in symptom resolution observed with BTX injection and myotomy treatment is promising, especially considering the influence of social media in raising awareness and promoting these treatment modalities. Other limitations include the inability to calculate mean and median time to follow up due to a lack of individualized data from original articles. The average time to loss of patient follow up was also not reported by many studies. Refractory symptoms could not be stratified by dose due to data reporting limitations by original articles. Future research is warranted to address these limitations and expand our understanding of the long-term outcomes and optimal management of R-CPD.

Conclusion

R-CPD is a relatively recently reported syndrome first described in 2019 by Bastian et al.[2] Clinical recognition is crucial to allow for timely, appropriate management leading to significant improvement in patient quality of life. Botulinum toxin injection has demonstrated high efficacy for initial treatment with minimal, transient postoperative side effects. Cricopharyngeal myotomy or subsequent botulinum toxin injections are currently reserved for refractory cases.

Author Contributions

Raj Malhotra, design, conduct, analysis, and presentation of research; **Hamza Khan**, design, conduct, analysis, and presentation of research; **Sydney Zaransky**, design, conduct, analysis, and presentation of research; **Joseph Celidonio**, design, conduct, analysis, and presentation of research; **Kenneth Yan**, design, analysis, and presentation of research; **Rachel Kaye**, design, analysis, and presentation of research.

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