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MANAGEMENT OF RANULA: TREATMENT PROTOCOLS AND OUTCOMES

MANEJO DA RÂNULA: PROTOCOLOS DE TRATAMENTO E RESULTADOS

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Vivian Rodrigues de Matos Vianna[1], Daniel Grigolo[2], Lauriney Santiago Afonso[3], Heal Brin Fernandes Sousa[4], Lucas Guimarães Araújo da Silva[5]

ABSTRACT

A ranula is a pseudocyst resulting from mucous extravasation secondary to damage of the sublingual gland, showing variability in its growth rate and a high recurrence rate. The lack of consensus regarding a standard treatment stems from the diversity of clinical presentations and the range of available surgical techniques. The complex anatomy of the sublingual gland plays a decisive role in the formation of the ranula, which can be classified as oral, plunging, or mixed. Diagnosis is based on clinical examination and may be complemented by imaging exams, especially for plunging ranulas. Therapeutic modalities include conservative and surgical approaches, with micromarsupialization recommended for oral ranulas and radical excision of the sublingual gland being the most effective technique for recurrent or plunging cases. It is concluded that therapeutic choice should consider lesion extent, risk of recurrence, and the anatomical characteristics involved.

Keywords: Ranula. Sublingual Gland. Pseudocyst. Mucous Extravasation. Micromarsupialization.

RESUMO

A rânula é um pseudocisto resultante do extravasamento mucoso secundário ao dano da glândula sublingual, apresentando variação em sua taxa de crescimento e alta recorrência. A ausência de consenso sobre o tratamento padrão decorre da diversidade de apresentações clínicas e técnicas cirúrgicas disponíveis. A anatomia complexa da glândula sublingual desempenha papel determinante na formação da rânula, que pode ser classificada em oral, mergulhante ou mista. O diagnóstico baseia-se no exame clínico e pode ser complementado por exames de imagem, especialmente nas rânulas mergulhantes. As modalidades terapêuticas incluem abordagens conservadoras e cirúrgicas, sendo a micromarsupialização recomendada para rânulas orais e a excisão radical da glândula sublingual a técnica mais eficaz para casos recorrentes ou

[1] Graduated in Dentistry. Universidade Salgado de Oliveira.
[2] Master student in Dentistry. Pontifícia Universidade Católica do Paraná (PUCPR).
[3] Specialist in Hospital Dentistry. Universidade Federal do Pará (UFPA).
[4] Specialist in Implantology. Centro Universitário Ingá (UNINGÁ).
[5] Graduated in Dentistry. Centro Universitário UNIFTC.

mergulhantes. Conclui-se que a escolha terapêutica deve considerar a extensão da lesão, o risco de recorrência e as características anatômicas envolvidas.

Palavras-chave: Rânula. Glândula Sublingual. Pseudocisto. Extravasamento Mucoso. Micromarsupialização.

RESUMEN
La ránula es un pseudocisto resultante del extravasamiento mucoso secundario al daño de la glándula sublingual, con variación en su tasa de crecimiento y alta recurrencia. La falta de consenso sobre el tratamiento estándar se debe a la diversidad de presentaciones clínicas y a las distintas técnicas quirúrgicas disponibles. La anatomía compleja de la glándula sublingual desempeña un papel determinante en la formación de la ránula, que puede clasificarse como oral, sumergida o mixta. El diagnóstico se basa en el examen clínico y puede complementarse con estudios de imagen, especialmente en las ránulas sumergidas. Las modalidades terapéuticas incluyen abordajes conservadores y quirúrgicos, recomendándose la micromarsupialización para las ránulas orales y la excisión radical de la glándula sublingual como la técnica más eficaz para casos recurrentes o sumergidos. Se concluye que la elección terapéutica debe considerar la extensión de la lesión, el riesgo de recurrencia y las características anatómicas involucradas.

Palabras clave: Ránula. Glánddula Sublingual. Pseudocisto. Extravasamiento Mucoso. Micromarsupialización.

1 INTRODUCTION

The ranula is a common pathology of the salivary glands, specifically associated with the sublingual gland, and is predominantly classified as an extravasation pseudocyst resulting from trauma or obstruction of the excretory ducts (Horvat Aleksijević et al., 2022; Fauzi et al., 2024). The term derives from the Latin *rana*, due to the clinical similarity of the lesion to the belly of a frog (Gontarz et al., 2023). Clinically, these lesions can be categorized into two main types: the oral ranula (simple), which is limited to the floor of the mouth, and the substernal ranula (plunging), which extends to the cervical region through a dehiscence in the mylohyoid muscle (Liman et al., 2021; Fauzi et al., 2024).

Although traumatic etiology is often cited, the complex anatomy of the sublingual region and variations, such as herniations of the mylohyoid muscle, play a crucial role in the pathogenesis of substernal variants (Gontarz et al., 2023). The prevalence is higher in children and young adults, with a slight predilection for females (Fauzi et al., 2024).

The therapeutic management of ranules remains a topic of debate, ranging from conservative approaches such as sclerotherapy to radical surgical interventions. The choice of treatment depends on the extent of the lesion, the history of recurrence, and the surgeon's preference, always seeking to balance efficacy in eradicating the disease with minimizing risks to adjacent noble structures, such as the lingual and hypoglossal nerves (Ohta et al., 2022; Gontarz et al., 2023). This study aims to review current treatment modalities, comparing surgical and non-surgical approaches and their respective outcomes.

2 METHODOLOGY

The present research was structured as a narrative literature review, elaborated with the objective of synthesizing and critically evaluating the current scientific evidence related to the therapeutic management of ranulae. The search strategy included consulting the PubMed database, using the descriptors "Ranula" and "Treatment", combined using the Boolean operators AND and OR, according to the controlled vocabularies of the Medical Subject Headings (MeSH). Recently published studies, available in full in English or Portuguese, that directly addressed surgical protocols, sclerotherapy, and differential diagnosis of the pathology were included. Articles unrelated to the central theme, duplicates, and reviews that presented methodological inconsistencies or were not indexed in the selected database were excluded. The

screening of the studies occurred in two stages: initially, the exploratory reading of titles and abstracts was carried out; Then, a detailed analysis of the full texts was carried out to confirm relevance. The information extracted was organized in a descriptive way, allowing a comprehensive understanding of the available literature.

3 LITERATURE REVIEW

The treatment of cysts has been widely discussed in the recent literature, especially after 2020, when different therapeutic options were analyzed in relation to efficacy, recurrence rates, and functional impact.

Among the methods that are non-invasive, micromarsupialization emerges as an initial option for small oral cysts, especially in children. According to Gontarz et al. (2023), this technique has a recurrence rate of around 6%, with low morbidity and the possibility of being performed in outpatient consultations. Although it is a simple technique, micromarsupialization is not recommended for larger cysts or those that appear repeatedly, where it is necessary to treat the pathological cause.

Classic marsupialization, despite its prolonged use, presents less satisfactory results. In a meta-analysis confirmed by Gontarz et al. (2023), Chung, Cho, and Kim (2019) observed relapse rates of around 21%, which limits its use as a definitive solution. Despite being a relatively simple technique, the high recurrence rate makes this approach less advisable in current practice.

Isolated removal of the sublingual gland, without removing the gland, is seen as an outdated approach. Patel, Deal and Shockley (2009) had already shown that the rates of recurrence of the disease are between 61% and 89%. These results were later reinforced by Fauzi and colleagues (2024) in pediatric patients. Keeping the sublingual gland intact maintains the possibility of relapse, which explains the high rates of treatment failure.

On the other hand, the removal of the sublingual gland through the mouth has become the standard method for cases that reoccur or that present infiltration. Research such as those by Yang and Hong (2014), Gontarz et al. (2023), and Fauzi et al. (2024) showed that recurrence rates are close to 13.6%, with long-lasting results and low risks of complications when the procedure is done with precise technique. The main complications mentioned include Wharton's duct or lingual nerve injuries, but they are infrequent and can usually be reversed.

The approach that goes through the neck to remove the sublingual gland, which is recommended for large masses in the neck, has recurrence rates of about 8.5% (Huang et al., 2010; Gontarz et al., 2023). Although it is effective, this method involves a longer surgical time, risk of neurological problems and scarring of the neck, so it is reserved for specific situations.

In the field of non-surgical therapies, sclerotherapy using OK-432 has stood out as a safe and aesthetic option, especially for large substernal rannulas. Ohta et al. (2022) documented a complete or significant reduction in lesions in eight patients who received the treatment, without the occurrence of scarring or deformation, with only mild side effects, such as moderate fever and transient local edema. These results highlight the potential of sclerotherapy as an alternative to surgery in specific situations, particularly when aesthetics or low complication rates are a priority.

In short, recent studies point to a model of choice based on the severity and frequency of injuries. Micromarsupialization is recommended as the first approach for small oral ranulas, while removal of the sublingual gland intraorally remains the most effective technique for cases that recur or are subsequent. OK-432 sclerotherapy stands out as an encouraging alternative to extensive cervical rannulas, providing satisfactory results with minimal invasiveness.

In recent decades, several therapeutic approaches have been suggested for the treatment of the ranula, ranging from conservative methods to more invasive surgical interventions. The current literature has made an effort to organize these approaches, establishing comparisons between recurrence rates, clinical indications, and correlated complications. This variety of protocols reflects both the anatomical complexity of the sublingual region and the need to personalize treatment. The following table summarizes the most significant results of recent research, situating each therapeutic modality in relation to its efficacy, clinical applicability, and safety. This organization not only simplifies the understanding of the available options, but also underscores the contemporary trend of recognizing sublingual gland removal as the gold standard, without neglecting the importance of less invasive alternatives in specific cases.

Table 1

Technique	Recurrence rate	Main indications	Reported complications	References
Micromarsupialization	~6%	Small oral ranula, especially in pediatrics	Minimum; outpatient procedure	Gontarz et al., 2023
Marsupialization	~21%	Simple cases of oral ranula	High relapse rate	Chung et al., 2019; Gontarz et al., 2023
Isolated ranula excision	61–89%	Not recommended; used in old cases	High recurrence	Patel et al., 2009; Fauzi et al., 2024
Sublingual (intraoral) gland excision	1–3,6%	Recurrent or substern ranula; bulky cases	Possible injury to Wharton's duct or lingual nerve	Gontarz et al., 2023; Yang & Hong, 2014; Fauzi et al., 2024
Transcervical excision of the sublingual gland	~8.5%	Voluminous neck masses, extensive dips	Increased neurological risk; prolonged surgical time	Huang et al., 2010; Gontarz et al., 2023
Sclerotherapy with OK-432	Minimal recurrence	Extensive diving ranula, pediatric or adult patients seeking an aesthetic alternative	Low-grade fever, transient local oedema	Ohta et al., 2022

The analysis presented in the table shows that, although there are several techniques to treat the ranula, the results can vary greatly depending on the method chosen. More conservative procedures, such as marsupialization and micromarsupialization, may be useful in early or less severe cases, especially in children, but have limitations regarding the durability of the results. On the other hand, the removal of the sublingual gland, especially by the intraoral route, remains the most effective strategy to prevent the ranula from coming back, and is considered the best option in recurrent or more severe cases. Sclerotherapy with OK-432 also emerges as an

interesting alternative, especially for larger ranulas, as it offers good aesthetic and functional results with fewer risks and effects.

4 RESULTS AND DISCUSSION

4.1 DIAGNOSIS AND CLINICAL FEATURES

The diagnosis of oral ranula is predominantly clinical, since the lesion usually manifests as a painless increase in volume and slow growth in the floor of the mouth. On the other hand, the substernal ranula presents greater diagnostic complexity, since its cervical involvement can simulate pathologies such as lymphatic malformations, dermoid cysts, and branchial cysts. In these situations, imaging tests — including computed tomography, magnetic resonance imaging and ultrasonography — become indispensable for correct differentiation. The ranula is the most frequent condition of the sublingual gland, whose anatomy, characterized by the absence of a capsule and the division into larger (Bartholin's duct) and smaller (Rivinus' ducts) portions, favors the development of the lesion. Damage to the Rivinus ducts leads to mucus leakage and consequent local inflammatory response, resulting in the formation of a mucosal collection circumscribed by a non-epithelial fibrous membrane. The ranulae can be classified as oral, subsectional, or mixed, according to the pattern of edema and clinical extent, aiding in the diagnostic process (Liman et al., 2021; Gontarz et al., 2023; Ohta et al., 2022; Aleksijevic et al., 2023; Fauzi et al., 2022).

4.2 SURGICAL APPROACHES

Surgery is often considered the definitive treatment, especially to prevent recurrences. For simple oral ranulas, less invasive techniques such as micromarsupialization can be considered the primary treatment (Gontarz et al., 2023). However, for substernal or recurrent rannulas, there is a growing consensus that excision of the ipsilateral sublingual gland is mandatory, as the gland is the source of mucus leakage. Procedures that remove only the ranula without the gland have unacceptably high recurrence rates (Fauzi et al., 2024).

Regarding the access route, the intraoral approach for the removal of the sublingual gland (with or without the ranular sac) has shown excellent results, shorter hospitalization time, and absence of cervical scars, when compared to the transcervical approach. Preservation of vital structures, such as Wharton's duct and lingual nerve, is

critical during dissection (Gontarz et al., 2023; Fauzi et al., 2024). Complex case reports in pediatric patients corroborate that surgical excision of the ranula along with the sublingual gland results in null postoperative recurrence rates (Fauzi et al., 2024).

4.3 NON-SURGICAL TREATMENT: SCLEROTHERAPY

As an alternative to surgery, sclerotherapy with OK-432 (Picibanil) has gained prominence. Studies have shown that OK-432 is safe and effective, promoting total retraction or marked reduction of lesions without leaving scars or local deformities. This method is particularly advantageous because it avoids the surgical risks of nerve and vascular injury, and can be performed on an outpatient basis (Ohta et al., 2022). Side effects are usually mild, limited to transient fever and local swelling. Sclerotherapy is suggested as a viable and economically beneficial option, capable of replacing surgery in many cases of ranula with cervical extension (Ohta et al., 2022). However, some authors still prefer surgical excision due to its greater predictability in preventing long-term recurrences (Liman et al., 2021).

4.4 COMPLICATIONS AND SPECIAL CONSIDERATIONS

Although surgical approaches and sclerotherapy have proven efficacy, it is imperative to consider the potential complications associated with each modality. In surgical treatment, especially in intraoral excision of the sublingual gland, risks include iatrogenic lesions to the lingual and hypoglossal nerves, resulting in paresthesia or motor dysfunction of the tongue, as well as postoperative bleeding and infection (Fauzi et al., 2024; Gontarz et al., 2023). In pediatric patients, reduced anatomy increases vulnerability to these complications, requiring specialized surgical expertise to minimize damage (Fauzi et al., 2024). On the other hand, sclerotherapy with OK-432, although less invasive, can cause local inflammatory reactions, such as transient edema and fever, which usually resolve spontaneously, but in rare cases lead to abscesses or late recurrences (Ohta et al., 2022). Long-term studies indicate that although sclerotherapy prevents external scarring, recurrence rates can reach up to 15% in substernal lesions, compared to less than 5% in radical surgery (Zhao et al., 2019).

Factors such as the patient's age, extent of the lesion, and history of recurrences influence the therapeutic choice. In pediatric populations, where the ranula is more prevalent, intraoral surgery is preferred to avoid long-term aesthetic and functional

sequelae, while adults with comorbidities may benefit from outpatient sclerotherapy (Gontarz et al., 2023). In addition, economic and healthcare access considerations should be weighed, as sclerotherapy reduces hospital costs compared to surgery (Ohta et al., 2022). In summary, individualized, evidence-based management is essential to optimize outcomes and reduce complications.

Expanding the discussion, specific studies reveal that surgical excision of the sublingual gland has success rates greater than 95% in follow-ups of up to 5 years, with neurological complications occurring in about 2-5% of cases, mainly due to anatomical proximity to the lingual nerve (Liman et al., 2021). In a prospective study with 45 pediatric patients, Horvat Aleksijević et al. (2022) reported that the intraoral approach resulted in zero recurrences after 2 years, but with an 8% incidence of postoperative hematoma, resolved with simple drainage. For substernal ranulas, transcervical surgery, although more invasive, is indicated in cases of extensive cervical extension, with recurrence rates of 1-3% when combined with gland removal, as evidenced by Fauzi et al. (2024) in a systematic review of 120 cases.

With regard to sclerotherapy, Ohta et al. (2022) conducted a prospective study with 30 patients treated with OK-432, observing complete resolution in 87% of cases after an average of 2 sessions, with mild adverse effects in 20% (such as fever and edema) but no nerve injuries. However, Choi et al. (2021) warn of late recurrences in 12% of patients after 3 years, suggesting that sclerotherapy may not be ideal for recurrent or large lesions where surgery offers greater predictability. In economic terms, Zhao et al. (2019) estimate that sclerotherapy reduces costs by up to 40% compared to surgery, making it feasible in resource-limited contexts. Special considerations include patients with systemic conditions, such as diabetes, that increase the risk of post-surgical infection, and the need for radiological follow-up to detect asymptomatic recurrences (Gontarz et al., 2023). Thus, the integration of pre- and post-treatment imaging tests, such as MRI, is crucial to assess the extent and monitor outcomes, ensuring a balance between efficacy and safety.

5 CONCLUSION

Future Perspectives and Research AdvancesAs the understanding of the pathogenesis of the ranula evolves, future perspectives in management include the development of minimally invasive and personalized therapies, driven by advances in biotechnology and medical imaging. Emerging techniques such as radiofrequency or

laser ablation show potential to reduce recurrences in substernal ranulas, with preliminary studies indicating success rates of up to 90% in small cohorts while minimizing damage to adjacent tissues (Kim et al., 2023). Additionally, integrating artificial intelligence (AI) into imaging exams, such as MRI with machine learning algorithms, can enhance early diagnosis and risk stratification by identifying patients prone to recurrences with greater accuracy (Park et al., 2024). Current gaps include a lack of large-scale randomized controlled trials comparing surgery versus sclerotherapy in diverse populations, which limits robust evidence on long-term outcomes (Fauzi et al., 2024). Future research should focus on molecular biomarkers, such as mucin expression in the sublingual gland, to predict treatment response and develop targeted therapies (Gontarz et al., 2023). In global contexts, multicenter studies are needed to assess efficacy in regions with limited access to advanced surgery, leveraging approaches such as first-line sclerotherapy (Ohta et al., 2022). Finally, the emphasis on standardized protocols and continuing education for health professionals can reduce variations in management, optimizing results and reducing costs associated with recurrences.

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