



## ***Evaluation of parathyroid adenomas in patients with hypercalcemia: treatment options and surgical outcomes***

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### **LITERATURE REVIEW**

#### **RESUMO**

Introdução: Adenomas de paratireóide são tumores benignos que causam hiperparatireoidismo primário, levando a hipercalcemia, uma condição caracterizada pelo aumento excessivo dos níveis de cálcio no sangue. Esta condição pode provocar sintomas como fadiga, fraqueza, e problemas ósseos e renais. A identificação e o tratamento eficaz desses adenomas são cruciais para aliviar os sintomas e prevenir complicações graves. O tratamento geralmente envolve a ressecção cirúrgica do adenoma, e a escolha do método cirúrgico pode impactar significativamente os resultados clínicos. Objetivo: Avaliar as opções de tratamento para adenomas de paratireóide em pacientes com hipercalcemia, focando nas técnicas diagnósticas e nos resultados cirúrgicos associados a esses tratamentos. Metodologia: Seguindo o checklist PRISMA, foram realizadas buscas nas bases de dados PubMed, Scielo e Web of Science. Utilizou-se uma combinação dos descritores "adenoma de paratireóide", "hipercalcemia", "hiperparatireoidismo primário", "opções de tratamento" e "resultados cirúrgicos". Os critérios de inclusão foram: artigos publicados nos últimos 10 anos, estudos envolvendo pacientes com adenomas de paratireóide e descrições de métodos e resultados cirúrgicos, e publicações em inglês, português ou espanhol. Foram excluídos estudos que não detalhavam resultados cirúrgicos específicos, artigos focados em condições diferentes de adenoma de paratireóide, e revisões ou meta-análises sem dados originais. Resultados: Os estudos revisados confirmaram que a cirurgia é a abordagem principal para tratar adenomas de paratireóide com hipercalcemia. A cintilografia com tecnécio-99m e a ultrassonografia foram destacadas como ferramentas eficazes na localização dos adenomas. A paratireoidectomia minimamente invasiva mostrou resultados comparáveis à cirurgia convencional, com vantagens como menor tempo de recuperação e menos complicações. A correta identificação do adenoma e a escolha do procedimento cirúrgico apropriado foram cruciais para o sucesso do tratamento. O acompanhamento pós-operatório para monitoramento dos níveis de cálcio foi igualmente importante. Conclusão: O tratamento cirúrgico continua sendo a principal opção para adenomas de paratireóide associados à hipercalcemia. As técnicas de imagem e as abordagens minimamente invasivas têm melhorado os resultados cirúrgicos e reduzido complicações. Um diagnóstico preciso e uma

abordagem cirúrgica bem planejada são essenciais para otimizar os resultados e melhorar a qualidade de vida dos pacientes.

**Palavras-chaves:** "adenoma de paratireóide", "hipercalcemia", "hiperparatireoidismo primário", "opções de tratamento" e "resultados cirúrgicos".

#### **ABSTRACT**

**Introdução:** Adenomas de paratireóide são tumores benignos que causam hiperparatireoidismo primário, levando a hipercalcemia, uma condição caracterizada pelo aumento excessivo dos níveis de cálcio no sangue. Esta condição pode provocar sintomas como fadiga, fraqueza e problemas ósseos e renais. Identificar e tratar eficazmente esses adenomas é crucial para aliviar os sintomas e prevenir complicações graves. O tratamento geralmente envolve a ressecção cirúrgica do adenoma, e a escolha do método cirúrgico pode impactar significativamente os resultados clínicos. **Objetivo:** Avaliar as opções de tratamento para adenomas de paratireóide em pacientes com hipercalcemia, focando nas técnicas diagnósticas e nos resultados cirúrgicos associados a esses tratamentos. **Metodologia:** Seguindo o checklist PRISMA, foram realizadas buscas nas bases de dados PubMed, Scielo e Web of Science. Utilizou-se uma combinação dos descritores "adenoma de paratireóide", "hipercalcemia", "hiperparatireoidismo primário", "opções de tratamento" e "resultados cirúrgicos". Os critérios de inclusão foram: artigos publicados nos últimos 10 anos, estudos envolvendo pacientes com adenomas de paratireóide e descrições de métodos e resultados cirúrgicos, e publicações em inglês, português ou espanhol. Foram excluídos estudos que não detalhavam resultados cirúrgicos específicos, artigos focados em condições diferentes de adenoma de paratireóide, e revisões ou meta-análises sem dados originais. **Resultados:** Os estudos revisados confirmaram que a cirurgia é a abordagem principal para tratar adenomas de paratireóide com hipercalcemia. A cintilografia com tecnécio-99m e a ultrassonografia foram destacadas como ferramentas eficazes na localização dos adenomas. A paratireoidectomia minimamente invasiva mostrou resultados comparáveis à cirurgia convencional, com vantagens como menor tempo de recuperação e menos complicações. A correta identificação do adenoma e a escolha do procedimento cirúrgico apropriado foram cruciais para o sucesso do tratamento. O acompanhamento pós-operatório para monitoramento dos níveis de cálcio foi igualmente importante. **Conclusão:** O tratamento cirúrgico continua sendo a principal opção para adenomas de paratireóide associados à hipercalcemia. As técnicas de imagem e as abordagens minimamente invasivas têm melhorado os resultados cirúrgicos e reduzido complicações. Um diagnóstico preciso e uma abordagem cirúrgica bem planejada são essenciais para otimizar os resultados e melhorar a qualidade de vida dos pacientes.

**Keywords:** Parathyroid adenoma, Hypercalcemia, Primary hyperparathyroidism, Treatment options, Surgical outcomes



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## **INTRODUCTION:**

Assessment and treatment of parathyroid adenomas are crucial for managing hypercalcemia, a condition resulting from an excess of calcium in the blood. The detection of these adenomas, which are benign tumors of the parathyroid glands, begins with laboratory tests identifying elevated levels of calcium and parathyroid hormone. These laboratory tests are followed by imaging methods, which play a critical role in the exact localization of the adenomas. Technetium-99m scintigraphy, an exam that uses a radioisotope to identify the activity of the parathyroid glands, and ultrasound, which uses sound waves to visualize internal structures, are frequently employed to map the tumors. The accuracy of these exams is essential for deciding on the surgical approach.

Surgical treatment is the primary method for addressing parathyroid adenomas associated with hypercalcemia. Parathyroidectomy, which is the surgical removal of the adenoma, is the standard procedure to correct primary hyperparathyroidism and normalize blood calcium levels. In recent years, minimally invasive parathyroidectomy has become a preferred technique. This method offers significant advantages, such as quicker recovery and a lower risk of complications compared to conventional surgery. The success of the treatment depends on the precise identification of the adenoma and the appropriate choice of surgical technique. Thus, the combination of accurate diagnosis and suitable surgical intervention is essential for improving clinical outcomes and patient quality of life.

Effective management of parathyroid adenomas in patients with hypercalcemia also involves a thorough understanding of imaging methods, surgical outcomes, and postoperative follow-up. Imaging techniques play a critical role in locating and evaluating adenomas before surgical intervention. Technetium-99m scintigraphy, which marks the metabolic activity of the parathyroid glands, and ultrasound, which directly visualizes the glandular structures, are essential for detailed and accurate tumor visualization. The appropriate choice between these techniques, often based on the patient's individual characteristics and the physician's experience, can influence treatment effectiveness.



Surgical outcomes vary based on diagnostic accuracy and the adopted approach. Minimally invasive parathyroidectomy has emerged as an effective technique, offering advantages over conventional approaches such as shorter hospitalization times and faster recovery. However, the procedure's effectiveness is closely linked to the correct identification of the adenoma and careful execution of the chosen technique. The comparison between minimally invasive and traditional surgery remains a field of interest to improve outcomes and reduce complications.

In addition to surgical intervention, postoperative follow-up is crucial for ensuring the long-term success of the treatment. After the adenoma removal, monitoring blood calcium levels is essential to confirm normalization and detect possible recurrences early. Adequate follow-up can prevent complications, such as hypocalcemia, and ensure full patient recovery. Effective postoperative management involves regular visits to an endocrinologist and periodic laboratory tests to adjust treatment as needed. The combination of these elements is vital for overall success in treating parathyroid adenomas and improving patients' quality of life.

## **METHODOLOGY**

The methodology for the systematic review was developed according to the PRISMA checklist, which ensures rigor and transparency in the selection and analysis of studies. Initially, detailed criteria were established for the inclusion and exclusion of articles to ensure the relevance and quality of the collected data.

Searches were conducted in the PubMed, Scielo, and Web of Science databases using the following descriptors: "parathyroid adenoma," "hypercalcemia," "primary hyperparathyroidism," "treatment options," and "surgical outcomes." These descriptors were selected to comprehensively cover diagnostic and therapeutic aspects related to the topic.

The inclusion criteria were defined as follows: (1) Articles published in the last 10 years to ensure that the information was current and relevant to



contemporary clinical practices. (2) Studies that included patients diagnosed with parathyroid adenomas and discussed treatment methods and their surgical outcomes, ensuring the relevance of the information for the review. (3) Publications presenting original data and detailed analyses, allowing for a critical evaluation of the evidence. (4) Articles written in English, Portuguese, or Spanish to facilitate the accessibility and understanding of the reviewed content. (5) Works specifically addressing imaging methods and surgical techniques for parathyroid adenomas, ensuring that the review covered all relevant aspects of treatment.

Exclusion criteria were established to ensure the accuracy and relevance of the analyzed data: (1) Studies that did not provide specific details on surgical outcomes or the effectiveness of interventions, limiting the usefulness of the information for the review. (2) Articles focused on conditions other than parathyroid adenomas to avoid the inclusion of irrelevant data. (3) Reviews, meta-analyses, or articles that did not present original data, as the review sought direct evidence. (4) Studies that did not include patients with hypercalcemia or did not discuss diagnostic and treatment methods pertinent to the topic. (5) Publications in languages other than those previously established, which could compromise the analysis and consistency of the data.

The selection of works was conducted in two stages. First, articles were filtered based on titles and abstracts, following the inclusion and exclusion criteria. Then, the full texts of the selected articles were assessed to confirm compliance with the established criteria. This approach ensured the inclusion of relevant studies and the exclusion of inadequate information, resulting in a systematic review that accurately and comprehensively reflects practices and outcomes in the treatment of parathyroid adenomas with hypercalcemia.

## **RESULTS**

Laboratory diagnosis plays a crucial role in identifying parathyroid adenomas and assessing primary hyperparathyroidism. Initial laboratory tests are focused on measuring blood calcium and parathyroid hormone levels, both of which are essential indicators for diagnosing this condition. Hypercalcemia, or elevated calcium levels, is a primary marker suggesting the presence of a parathyroid adenoma. Parathyroid hormone levels are equally important, as

elevated levels confirm primary hyperparathyroidism, characterized by the excessive production of this hormone by the parathyroid glands.

In addition, laboratory evaluation is complemented by additional tests such as urinary calcium measurement and vitamin D levels, which help differentiate the cause of hypercalcemia. The combination of these tests provides a more complete clinical picture and guides the need for further investigations. Therefore, an accurate and comprehensive laboratory diagnosis is essential for confirming the presence of parathyroid adenomas and determining the appropriate treatment.

Imaging methods are also indispensable for detecting and locating parathyroid adenomas. Technetium-99m scintigraphy is a widely used nuclear imaging technique that involves administering a radioisotope to assess the activity of the parathyroid glands. This exam allows detailed visualization of the glands and identification of areas with abnormal activity, indicative of the presence of adenomas. Scintigraphy's ability to differentiate between normal and hypertrophied parathyroid glands is crucial for surgical planning.

Ultrasound is another critical diagnostic tool, using sound waves to create real-time images of the parathyroid glands. This technique is particularly effective for visualizing superficial tumors and guiding biopsy when needed. Combining these imaging techniques enhances diagnostic accuracy and helps map the exact location of adenomas, facilitating the selection of the most appropriate surgical procedure. Thus, integrating imaging methods with laboratory tests provides a comprehensive approach to the diagnosis and management of parathyroid adenomas.

Surgical indication is based on the diagnostic confirmation of parathyroid adenomas and the assessment of symptoms associated with hypercalcemia. Initially, surgery is considered when primary hyperparathyroidism is confirmed through laboratory and imaging tests. The presence of adenomas in the parathyroid glands, identified by scintigraphy or ultrasound, is a decisive criterion for surgical decision-making. Additionally, the presence of severe symptoms, such as muscle weakness, bone pain, or kidney stones, generally accelerates the indication for surgical intervention. The absence of treatment can lead to significant complications and progression of symptoms, justifying the need for





definitive treatment.

The choice of surgical treatment is also influenced by the severity of symptoms and the effectiveness of conservative methods. Patients with severe hypercalcemia or those who do not respond to non-invasive clinical measures, such as hydration or diuretics, often require surgery. The goal of the intervention is to remove the adenoma responsible for excessive parathyroid hormone secretion, thereby restoring calcium balance and alleviating related symptoms. Therefore, the decision to perform surgery is carefully considered, taking into account both the severity of the condition and the potential for improving the patient's quality of life.

Minimally invasive parathyroidectomy has become a preferred approach for treating parathyroid adenomas. This surgical method is characterized by a smaller incision and quicker recovery compared to conventional surgery. Using techniques such as video laparoscopy, minimally invasive parathyroidectomy reduces hospitalization time and postoperative complication risks. Accurate localization of the adenoma, facilitated by advanced imaging tests, allows the surgery to be performed with minimal trauma to the patient and a high success rate in normalizing calcium levels.

In addition to recovery benefits, minimally invasive parathyroidectomy provides a more satisfactory aesthetic result due to the smaller scar resulting from the procedure. This type of surgery is often preferred in cases where the adenoma is clearly located and access can be achieved with minimal precision. However, the selection of this approach depends on the surgeon's experience and the specific characteristics of the adenoma. In many cases, the choice between minimally invasive parathyroidectomy and conventional approaches is based on detailed preoperative evaluation and patient preference, ensuring the effectiveness and safety of the treatment.

Conventional parathyroidectomy remains a viable alternative when minimally invasive parathyroidectomy is not appropriate or cannot be performed successfully. This traditional method involves a wider incision in the neck, allowing direct access to the parathyroid glands. The conventional approach is often chosen when the adenoma's location is not well-defined by imaging methods or when the patient has complex anatomy. Although this procedure may





result in longer recovery and greater hospitalization time, it provides a comprehensive view of the parathyroid glands, allowing for the removal of multiple adenomas or identification of other anomalies.

Performing conventional parathyroidectomy requires considerable technical skill and detailed anatomical knowledge to minimize the risk of complications, such as damage to adjacent structures, including the larynx and salivary glands. During surgery, ensuring complete removal of the adenoma is crucial to prevent persistence or recurrence of hypercalcemia. Although recovery time is longer compared to minimally invasive approaches, conventional parathyroidectomy allows direct and thorough evaluation of the parathyroid glands, which can be essential in cases of diagnostic or anatomical difficulty. Thus, despite the associated disadvantages, it remains an important option in clinical practice for managing parathyroid adenomas.

Preoperative evaluation is a crucial step in managing parathyroid adenomas, aiming to ensure that all relevant aspects of the patient's condition are considered before surgery. Initially, reviewing laboratory and imaging tests is essential to confirm the diagnosis and plan the surgical approach. Combining laboratory tests, including measuring calcium and parathyroid hormone levels, with imaging tests such as scintigraphy and ultrasound provides a detailed view of the adenoma's location and characteristics. These data are fundamental for choosing the most appropriate surgical technique and anticipating potential difficulties during the operation.

Additionally, preoperative evaluation should consider the patient's overall health, including the presence of comorbidities that may influence surgical outcomes. Additional tests, such as cardiac or respiratory assessments, may be necessary to ensure the patient is fit for the procedure. Consultation with an endocrinologist and review of any current medications are also critical components of this phase, ensuring that all variables are controlled before the intervention. This comprehensive approach minimizes risks and improves the likelihood of a successful surgical outcome.

Surgical outcomes are assessed based on several indicators, including the effectiveness of adenoma removal and the normalization of calcium levels postoperatively. The success of the procedure is often measured by a significant



reduction in calcium and parathyroid hormone levels, which should occur soon after surgery. Improvement in symptoms associated with hypercalcemia, such as muscle weakness and bone pain, is also an important indicator of treatment success. Furthermore, the absence of postoperative complications, such as infections or hypocalcemia, is essential for a positive evaluation of surgical results.

Postoperative follow-up includes regular monitoring of calcium and parathyroid hormone levels to ensure that primary hyperparathyroidism has been effectively treated and to detect any signs of early recurrence. Follow-up consultations with an endocrinologist are necessary to adjust treatment as needed and to address any potential adverse effects. Continuous evaluation of the patient's condition is crucial for ensuring a full recovery and optimizing long-term management of the condition. Thus, analyzing surgical results and adequate follow-up are key to the overall success of treatment and improvement in the patient's quality of life.

Monitoring postoperative complications is an essential component in the recovery of patients undergoing surgery for parathyroid adenomas. After adenoma removal, the primary concern is the possibility of hypocalcemia, a condition resulting from a sudden drop in blood calcium levels. Hypocalcemia can manifest as symptoms such as tingling, muscle cramps, and, in severe cases, seizures. Therefore, it is crucial to perform regular measurements of serum calcium levels in the immediate postoperative period to detect and promptly treat any deviation from normal levels. Proper management of hypocalcemia often involves the administration of calcium and vitamin D supplements, as well as continuous monitoring to adjust treatment as needed.

In addition to hypocalcemia, other potential complications include infections at the surgery site and damage to adjacent structures such as the salivary glands and nerves. Patient monitoring should include observing signs of infection, such as fever and purulent discharge, and conducting physical exams to assess potential damage to surrounding structures. Proactive management of these complications is essential to prevent the need for additional interventions and ensure a successful recovery. Rigorous follow-up and ongoing communication between the patient and the healthcare team are crucial for early



identification and resolution of issues.

Postoperative follow-up plays a vital role in evaluating the success of the treatment and managing the patient's condition continuously. This follow-up includes regular consultations with an endocrinologist to assess the effectiveness of the surgery and monitor changes in calcium and parathyroid hormone levels. Periodic laboratory tests are conducted to verify the normalization of hormone levels and detect any signs of recurrence of hyperparathyroidism. It is also a time to adjust any additional treatment required and provide guidance on postoperative care and lifestyle changes that may aid in recovery.

Furthermore, follow-up is an opportunity to evaluate the patient's quality of life, observing the resolution of symptoms that led to surgery and the overall impact of the intervention on the individual's health. Continuous support and patient education are essential for promoting adherence to the treatment plan and preventing future complications. Therefore, a well-structured follow-up program is crucial not only for ensuring complete recovery but also for optimizing long-term outcomes and improving the patient's quality of life.

Evaluating the impact of treatment on patients' quality of life is a crucial aspect of managing parathyroid adenomas, as it reflects the overall effectiveness of the intervention not only in clinical terms but also in the patients' lived experience. After surgery, it is essential to monitor the improvement of symptoms related to hyperparathyroidism, such as weakness, bone pain, and neuromuscular changes. The resolution of these symptoms can provide significant and immediate relief, improving the patient's functional capacity and overall well-being. Quality of life studies often use specific questionnaires to assess aspects such as pain, mobility, and mental health, providing a comprehensive view of how treatment impacts patients' daily lives.

Additionally, the long-term impact of treatment should be continuously evaluated to ensure that clinical benefits translate into lasting improvements in quality of life. Monitoring aspects such as continued normalization of calcium levels and absence of recurrences helps understand the prolonged effectiveness of the treatment and patient satisfaction with the results achieved. Postoperative recovery may involve lifestyle adjustments and ongoing follow-up, and it is essential to assess how these changes influence the patient's well-being. Thus,



detailed analysis of post-treatment quality of life provides valuable insights into the overall effectiveness of the therapeutic approach and its influence on patients' health and satisfaction.

## **CONCLUSION**

The review of approaches for treating parathyroid adenomas in patients with hypercalcemia revealed a detailed overview of current practices and their impacts. Parathyroid adenomas, responsible for excessive parathyroid hormone secretion, were identified as a significant cause of hypercalcemia, with surgical intervention emerging as the primary therapeutic strategy to restore calcium balance in the body.

The reviewed studies confirmed that precise diagnosis and thorough patient evaluation are crucial for choosing the appropriate treatment. Laboratory tests, such as measuring calcium and parathyroid hormone levels, and imaging techniques, like technetium-99m scintigraphy and ultrasound, played key roles in identifying and locating adenomas. The combination of these methods allowed for personalized treatment plans, maximizing surgical effectiveness.

Regarding treatment options, minimally invasive parathyroidectomy stood out for its advantages, including faster recovery and a lower risk of complications compared to conventional approaches. However, conventional parathyroidectomy remained a valid alternative in cases of complex anatomy or when adenoma location was not clearly defined. Both methods showed success in normalizing calcium levels, but the choice between them was often guided by the surgeon's experience and the patient's specific characteristics.

Postoperative follow-up proved essential for ensuring complete recovery and preventing complications. Patients required continuous monitoring for early detection of hypocalcemia and other potential complications. Studies showed that a proactive approach in postoperative management resulted in better outcomes and lower recurrence rates, highlighting the importance of a rigorous follow-up plan.

Additionally, the analysis of the impact on patients' quality of life after surgery indicated significant improvements in symptoms and overall well-being. Successful patient recovery was associated with a reduction in symptoms related



to hyperparathyroidism and substantial improvements in functional capacity and overall satisfaction. Therefore, surgical interventions for parathyroid adenomas, when performed accurately and followed up appropriately, resulted in substantial benefits both clinically and in terms of patients' quality of life. The integration of effective diagnostic strategies and a careful approach to treatment and follow-up were key to achieving these positive outcomes.

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