REVIEW ARTICLE

AGGRESSIVE FIBROMATOSIS OF THE JAW : A COMPREHENSIVE REVIEW

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ABSTRACT

Aggressive fibromatosis of the jaw (desmoid-type fibromatosis) is a rare, locally invasive tumor that falls between benign lesions and fibrosarcoma in behavior. Although its cells appear benign, it displays highly infiltrative growth and tends to recur locally. This review examines its epidemiology, underlying genetic mutations—primarily CTNNB1 interrupting the Wnt/β-catenin pathway—clinical features, diagnostics, and evolving treatments. Most cases occur in children and young adults, favouring the mandible. Patients often present with a painless, slow-growing mass, sometimes leading to airway issues. Diagnosis relies on tissue analysis and β-catenin immunostaining. Treatment has shifted from aggressive surgery to more conservative methods, including active surveillance, less invasive surgery with radiotherapy, and systemic therapies. Management requires a multidisciplinary approach focused on preserving function and quality of life, with ongoing monitoring due to unpredictable recurrence risk. Current strategies privilege organ-sparing while ensuring oncological safety.

KEY WORDS

Aggressive fibromatosis, desmoidtumour, jaw neoplasms, fibroblastic proliferation, β-catenin, CTNNB1 mutation

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INTRODUCTION[1-7]

Aggressive fibromatosis, also known as desmoid-type fibromatosis or desmoid tumour, represents a distinct category of mesenchymal neoplasms that occupy an intermediate position between benign fibrous lesions and frankly malignant fibrosarcomas.[1,2] Originally identified in medical reports more than 200 years ago, these tumours present a clinical paradox. Despite appearing non-malignant under the microscope, they behave aggressively, frequently invading surrounding tissues and exhibiting a high risk of local recurrence.[3,4]

The World Health Organization (WHO) classifies aggressive fibromatosis as an "intermediate, locally aggressive" tumour. This designation highlights its unique behaviour-while it does not spread to distant sites (metastasise), it can grow aggressively into nearby tissues. This local invasiveness often leads to considerable health challenges and functional limitations for patients.[3,5]This classification reflects the distinct biological characteristics of these lesions, setting them apart from benign reactive fibrous growths as well as from malignant soft tissue sarcomas. Aggressive fibromatosis occurring in the craniofacial area is exceptionally uncommon. When it does affect this region, involvement of the jawbones is sporadic, accounting for less than 5% of all fibromatosis cases.[1,6] When these tumours occur in the maxillofacial area, they present significant treatment challenges. This is because the region's intricate anatomy, the closeness to critical nerves and blood vessels, and the essential functions of the involved tissues make surgical and therapeutic interventions especially complex.[6,7]

Because aggressive fibromatosis in the jaw area is so uncommon, it has often posed challenges for accurate diagnosis and sparked debate over the best treatment methods. This rarity has also contributed to a limited body of knowledge regarding the most effective management strategies, highlighting the need for continued research and detailed case studies to improve clinical decision-making.[8,9] Recent progress in molecular pathology, especially the discovery of mutations in the CTNNB1 gene and disruptions in the Wnt/β-catenin signalling pathway,

has shed new light on how these tumours develop.[10,11]

Fibromatosis of the jaw is significant not only because of its rarity but also due to its frequent occurrence in children and young adults. In these populations, the lesions can profoundly affect vital functions like speech, swallowing, and breathing. Moreover, they may disrupt normal facial growth and development, posing additional challenges.[6,12] The intricate anatomy of the maxillofacial region frequently constrains the ability to remove aggressive fibromatosis tumours with the wide surgical margins usually recommended. This challenge underscores the necessity to investigate and develop alternative treatments that can manage the tumour effectively while safeguarding critical anatomical structures.

Epidemiology and Demographics

Incidence and Prevalence

Aggressive fibromatosis is a rare condition, making up only a tiny fraction-around 0.03%-of all tumours diagnosed across the population. When looking specifically at soft tissue tumours, they account for about 3% of cases.[3,14] Desmoid-type fibromatosis is quite rare, with researchers estimating its occurrence at about 3 to 5 new cases for every million people each year. However, the incidence can differ notably depending on geographic region and specific demographic factors.[3,15]

In the context of fibromatosis, only a small proportion-about 10 to 15%-arises in the head and neck area. Within this group, cases that specifically involve the jaw are even less common, comprising just a subset of these already rare tumours.[2,16] A review of published case studies shows that fibromatosis involving the jaw is quite rare, representing fewer than 5% of all aggressive fibromatosis diagnoses [7,17]

Research shows that jaw fibromatosis tends to affect the mandible far more often than the maxilla. About 70 to 75% of documented jaw cases involve the lower jaw.[9,18] The tendency of fibromatosis to develop more frequently in the mandible may be linked to several factors, including differences in how the jaw develops, patterns of trauma, or localised differences in how tissues respond to triggers that promote fibroblast growth. [8,19]

Age Distribution

Aggressive fibromatosis affecting the jaw shows a unique age-related pattern, with two main groups at higher risk.[8,12] The first and most prominent peak is seen in children, as around 40% of cases are identified in individuals under 10 years old.[12,20] A secondary, less pronounced increase in incidence occurs among young to middle-aged adults, typically during their 20's and 30's.[7,13]

The age pattern seen in jaw fibromatosis stands in contrast to that observed in other parts of the body, where these tumours most often appear in people in the fourth decade of life.[3,15] The fact that jaw cases are more common in children and young adults introduces unique challenges for treatment. For these younger patients, care teams must prioritise preserving function and supporting normal growth and development, making thoughtful, individualised treatment planning especially important from both clinical and research perspectives. [21,22]

Although congenital occurrences of this condition are pretty rare, they have been documented in medical studies.[8,12] When present at birth, these cases can cause severe difficulties with essential functions such as breathing and feeding, often necessitating immediate and coordinated care from a multidisciplinary team. Early recognition and prompt intervention are critical to managing these complex cases effectively and improving outcomes.[12,21]

Gender Distribution

When looking at jaw fibromatosis, there is a modest predominance of females affected, with most research showing that women outnumber men by about 1.2 to 1.5 times.[7,18] This trend aligns with what is observed in aggressive fibromatosis occurring in other parts of the body, where females are more commonly diagnosed.[3,15]

Interestingly, some research that zeroes in on paediatric cases of jaw fibromatosis has found a more balanced gender distribution, and in some instances, a slight predominance in males. These findings hint that hormonal influences might play a varying role in the development of this condition among different age groups.[8,12]

Anatomical Distribution

In cases of fibromatosis affecting the jaw, the mandible is noticeably involved more than the maxilla, with studies reporting that mandibular cases outnumber maxillary ones by approximately two to three times.[9,18,19] Within the mandible, the tumour most commonly arises in the posterior regions, such as the ramus and angle, with the body of the mandible being the following most frequent site.[8,23]

When aggressive fibromatosis involves the maxilla, it most commonly affects areas like the alveolar process and the maxillary sinus. In some cases, the lesion can extend further into nearby regions such as the ethmoid sinuses and the nasal cavity.[24,28] While involvement on both sides of the maxilla is rare, a few isolated instances have been documented.[7,13]

The way these tumours are distributed anatomically might be influenced by differences in the local tissue makeup, blood supply, or the frequency of trauma in certain areas. These regional factors could create conditions that make some

tissues more prone to the growth of fibroblasts.[8,9]

Aetiology and Pathogenesis

Molecular Pathogenesis

Our understanding of how aggressive fibromatosis develops at the molecular level has dramatically advanced with the identification of mutations in the CTNNB1 gene. This gene produces β-catenin, an essential player in the Wntsignalling pathway.[11,19] Somatic mutations of this kind are found in about 85% of aggressive fibromatosis cases, making them the leading molecular factor behind the development of the disease.[25,26]

The most common CTNNB1 mutations involve hotspot codons 41 (T41A) and 45 (S45F, S45P), which normally regulate the degradation of β-catenin.[10,27] These genetic mutations cause the β-catenin protein to become more stable and accumulate within the cell nucleus. As a result, there is persistent activation of Wnt pathway target genes-genes that play critical roles in regulating cell growth, specialisation, and the maintenance of normal tissue function.[11,25]

When it comes to fibromatosis of the jaw, the occurrence and distribution of CTNNB1 mutations closely mirror what is observed in fibromatosis affecting other parts of the body. This consistency suggests that the underlying molecular mechanisms are similar regardless of the tumour's location, reinforcing the central role of CTNNB1 mutations in the disease process.[18,28] Interestingly, some research indicates that desmoplastic fibromas arising in the jaw bone might show distinct immunohistochemical profiles compared to those found in soft tissues. These differences could be linked to their unique development from neural crest cells.[8,18]

Alternative Genetic Alterations

Although CTNNB1 mutations are the primary genetic change found in most cases of aggressive fibromatosis, recent research has uncovered other molecular abnormalities in a subset of patients. These new findings suggest that the genetic landscape of this disease is more complex than previously thought.[10,28] Recent advances in next-generation sequencing have identified new mutations in genes like BCL10, MPL, and RBM10 in some cases of aggressive fibromatosis. However, the specific roles these genetic changes play in the disease process are not yet fully understood.[10,28]

In about 15% of aggressive fibromatosis cases, no CTNNB1 mutations are found, indicating that other biological mechanisms may be involved in the development of the disease.[25,28] In some instances, mutations in the APC gene have been identified, especially among patients with familial adenomatous polyposis (FAP) syndrome.[29,30]

Hormonal Influences

Hormonal influences, especially the role of estrogen, seem to have a meaningful impact on the development and progression of aggressive fibromatosis.[11,31] Studies examining hormone receptor expression have found that estrogen receptor-β is present in a varying proportion of cases, ranging widely from about 7% to as high as 90%.[11,31]

The female predominance of aggressive fibromatosis, association with pregnancy and hormonal fluctuations, and reported responses to anti-estrogen therapy support the importance of hormonal influences in disease pathogenesis.[31,32] Despite growing evidence that hormonal factors influence aggressive fibromatosis, the precise ways in which these hormones interact with the Wnt/β-catenin signalling pathway are still not fully understood.

Trauma and Environmental Factors

About 20 to 30% of aggressive fibromatosis cases have been associated with a prior history of trauma. However, whether this relationship is truly causal remains a subject of debate within the research community.[6,33] In cases of jaw fibromatosis, possible traumatic triggers could involve events such as dental treatments, oral surgical interventions, or injuries to the maxillofacial area.[6,12]

The relationship between trauma and fibromatosis development may involve the disruption of standard tissue architecture, inflammatory responses, or the activation of fibroblastic proliferation through growth factor signalling cascades.[33,34] However, the majority of cases lack a clear traumatic precipitant, suggesting that trauma may represent a promoting factor rather than an initiating cause.

Familial and Genetic Predisposition

While most cases of aggressive fibromatosis are sporadic, a small subset occurs in the context of hereditary syndromes, particularly familial adenomatous polyposis (FAP).[30,35] Desmoidtumours linked to familial adenomatous polyposis (FAP) generally originate from inherited mutations in the APC gene. Compared to sporadic cases, these tumours often display a more intricate pattern of genetic changes.[29,30]

Gardner syndrome, a form of familial adenomatous polyposis (FAP) marked by numerous colon polyps, bony growths called osteomas, and various soft tissue tumours, has been linked to fibromatosis arising in the craniofacial region. However, occurrences involving the jaw remain uncommon within this subset of patients.[27,35] Identifying familial syndromes plays a crucial role in guiding genetic counselling and determining

appropriate screening strategies for family members.

Clinical Presentation and Natural History

Initial Presentation

Aggressive fibromatosis of the jaw typically presents as a gradually enlarging, painless mass that may initially be overlooked or misdiagnosed as a more common benign lesion.[1,12] The insidious onset and lack of characteristic symptoms often result in diagnostic delays, with many patients experiencing symptoms for months or years before obtaining a definitive diagnosis.[6,8]

In pediatric patients, the presentation may be more dramatic, with rapid growth and development of functional compromise over weeks to months.[6,12] Parents often report progressive facial asymmetry, difficulty with feeding or speech, or changes in dental occlusion as initial presenting symptoms.[12,22]

The painless nature of most jaw fibromatosis cases contrasts with that of other anatomical locations, where pain is a prominent feature.[36,37] However, advanced cases may develop pain due to compression of adjacent structures, nerve involvement, or secondary complications such as infection.[8,23]

Progressive Symptoms and Complications

As jaw fibromatosis enlarges, patients typically develop progressive functional impairment that may include difficulty with mastication, speech articulation, and swallowing.[6,12] Mandibular lesions may cause limitation of mouth opening (trismus), dental malocclusion, or displacement of teeth.[8,19]

Maxillary involvement can result in nasal obstruction, epistaxis, or extension into the paranasal sinuses, accompanied by associated symptoms of rhinosinusitis.[20,24] Advanced maxillary cases may demonstrate orbital involvement with diplopia, proptosis, or visual field deficits.[24,38]

The most serious complication of jaw fibromatosis is compromise of the upper airway, which can develop insidiously and progress to life-threatening respiratory distress.[6,12] This complication is more common in paediatric patients and may require urgent surgical intervention or tracheostomy for airway management[6,21]

Growth Patterns and Disease Progression

Aggressive fibromatosis of the jaw exhibits unpredictable growth patterns, which may include periods of rapid expansion alternating with phases of stability or even spontaneous regression.[15,39] This variability makes clinical management challenging and precludes reliable prediction of disease behaviour.[3,36]

In some patients, the tumour gradually grows over time, reaching a point where medical or surgical treatment becomes necessary. Conversely, other individuals may experience a more stable condition, where the disease does not advance significantly and can be safely monitored through active surveillance. The reasons behind the varying growth behaviours seen in these tumours are not yet obvious. They may be influenced by differences in the tumour's molecular characteristics, individual patient factors, or environmental exposures.[18,26]

Natural history studies indicate that roughly 20 to 30% of aggressive fibromatosis cases may experience spontaneous stabilization or even shrinkage without any medical intervention. This phenomenon of spontaneous regression or disease stability has been increasingly recognized in recent research, supporting the practice of initial active surveillance in many patients.[15,39] While some aggressive fibromatosis tumours may remain stable over time, it's essential to consider the jaw's critical role in functions such as chewing, speaking, and breathing. Even lesions that do not grow can still lead to ongoing symptoms and functional difficulties in this sensitive area.[36,40]

Quality of Life Impact

Patients with jaw fibromatosis experience significant impairment in health-related quality of life, with functional limitations affecting multiple domains, including physical function, emotional well-being, and social interactions.[3,36] Pain, when present, has been identified as a particularly important predictor of poor quality of life outcomes.[36,40]

Aesthetic concerns related to facial deformity represent another major quality of life issue, particularly in adolescent and young adult patients.[12,22] Because lesions in the jaw are often visible and can alter facial appearance, they may significantly affect a patient's social interactions and emotional well-being. Many individuals experience feelings of isolation, lowered self-esteem, and even depression as a result.[13,36]

The long-lasting nature of this condition, combined with its often unpredictable progression and risk of recurrence, can place a significant emotional strain on both patients and their families.[3,36] The chronic and often unpredictable course of this condition, along with the possibility of the disease coming back, can cause considerable emotional stress for patients and their loved ones.[13,40]

Diagnostic Approaches

Clinical Evaluation

The evaluation process for suspected jaw fibromatosis starts with a thorough clinical history

and a detailed physical examination.[8,31] Key elements to gather during the patient history include how long the growth has been present and its rate of progression, any accompanying symptoms the patient may be experiencing, a detailed family history with particular attention to polyposis syndromes, and documentation of any prior trauma or surgical interventions in the area.[31,35]

A thorough physical examination involves carefully evaluating the lesion's size, texture, and mobility. It is also essential to assess how the lesion relates to surrounding anatomical structures, as this information helps guide diagnosis, treatment planning, and deepens our understanding of the tumour's behaviour within the complex maxillofacial region.[8,37] Assessing oral functions such as mouth opening, speech clarity, and swallowing ability is essential for establishing a baseline of a patient's functional status.[12,22]

When evaluating jaw masses in children and young adults, it is essential to consider a wide range of possible causes. These can include both non-cancerous (benign) growths and malignant tumours.[8,9] Key clinical signs that might point toward aggressive fibromatosis include the patient's relatively young age, the typical absence of pain in the mass, and a slow but steady increase in its size over time.[1,12]

Imaging Studies

Important clinical indicators suggestive of aggressive fibromatosis include the patient being generally young, the lesion often presenting as painless, and a gradual yet consistent growth in size over time.[41,42] Multiple imaging modalities are typically employed to obtain a comprehensive assessment.[8,43]

Computed Tomography (CT)

CT imaging provides excellent visualisation of bone involvement and destruction patterns characteristic of aggressive fibromatosis of the jaw.[41,42] These lesions typically demonstrate expansile growth with cortical thinning or breakthrough, creating characteristic "soap bubble" or multilocular radiolucent appearances.[8,41]

The soft tissue component of jaw fibromatosis appears as a heterogeneous density on CT, often with areas of lower attenuation corresponding to myxoid or necrotic regions.[12,41] Enhancement patterns following intravenous contrast administration are variable but typically demonstrate heterogeneous enhancement.[31,42]

Magnetic Resonance Imaging (MRI)

Magnetic resonance imaging (MRI) is considered the preferred imaging technique for assessing the soft tissue involvement of jaw fibromatosis. It provides detailed visualisation of the tumour's size and extent, as well as its proximity and impact on nearby anatomical structures.[8,44] On T1-weighted MRI scans, aggressive fibromatosis lesions usually display an intermediate level of signal intensity. In contrast, T2-weighted images often reveal a combination of signal patterns, reflecting the tumour's varied and complex tissue makeup.[42,44]

The distinctive MRI features of aggressive fibromatosis typically show regions of low signal intensity on T2-weighted images, which correspond to dense fibrous tissue. These darker areas are interspersed with brighter regions that reflect myxoid or more cellular parts of the tumour.[42,45] The heterogeneous appearance, combined with the infiltrative growth pattern, helps distinguish fibromatosis from other soft tissue masses.[44,46]

Advanced Imaging Techniques

Functional imaging modalities such as 18F-FDG PET/CT have been employed in selected cases of aggressive fibromatosis, primarily for monitoring treatment response and detecting recurrence.[47,48] Despite the availability of these advanced imaging techniques, their usefulness in evaluating jaw fibromatosis is still somewhat limited. This limitation largely stems from the rarity of the condition and the absence of standardised guidelines for interpreting the imaging results.[47,49]

Tissue Sampling and Histopathological Diagnosis

A conclusive diagnosis of jaw fibromatosis can only be made by examining carefully selected tissue samples under the microscope through histopathological analysis.[31,50] Sampling tissue from the jaw can be tricky because of its complex anatomy and the nearby vital nerves and blood vessels. This means biopsies must be carefully planned and carried out by experienced head and neck surgeons to avoid complications and ensure accurate results.[8,13]

Biopsy Techniques

Core needle biopsy represents the preferred initial diagnostic approach when feasible, providing adequate tissue for histological and immunohistochemical analysis while minimising morbidity.[31,51] However, the firm, fibrous nature of these lesions may limit the yield of core biopsy procedures, necessitating open surgical biopsy in some cases.[8,50]

Incisional biopsy should be performed through a carefully planned approach that does not compromise subsequent definitive surgical procedures.[13,17] The biopsy tract should be oriented to allow for incorporation into any future surgical resection to minimise the risk of local seeding [37,50]

Histopathological Features

The histological diagnosis of aggressive fibromatosis relies on characteristic morphological features, including infiltrative growth pattern, uniform spindle cell proliferation, and abundant collagen deposition.[1,52] The cellular component consists of well-differentiated fibroblasts and myofibroblasts with minimal mitotic activity and absence of cytologic atypia.[37,52]

The infiltrative growth pattern represents a key diagnostic feature, with tumour cells extending between and around typical tissue structures in an irregular, "finger-like" pattern.[50,52] This growth pattern contrasts with the pushing borders typically seen in benign fibrous lesions.[50,53]

Immunohistochemical Analysis

Immunohistochemical studies play a crucial role in confirming the diagnosis of aggressive fibromatosis and excluding other spindle cell lesions in the differential diagnosis.[31,50] The most important marker is β-catenin, which demonstrates characteristic nuclear accumulation in the majority of cases.[18,31]

Nuclear β-catenin positivity is observed in approximately 85% of aggressive fibromatosis cases and correlates strongly with the presence of CTNNB1 mutations.[18,19] This finding is relatively specific for fibromatosis among spindle cell lesions and represents a valuable diagnostic tool.[31,53]

Additional immunohistochemical markers that may be employed include smooth muscle actin (SMA), which is variably positive in myofibroblastic cells, and Ki-67, which typically demonstrates low proliferative activity.[50,53] Negative staining for S-100 protein, desmin, and CD34 helps exclude other mesenchymal neoplasms[31,54]

Molecular Diagnostic Testing

Molecular analysis for CTNNB1 mutations has become an increasingly important component of the diagnostic evaluation for aggressive fibromatosis.[10,28] These analyses can confirm a diagnosis and even offer insights into likely outcomes, although how each specific mutation influences patient prognosis is still being explored.[26,28]

Next-generation sequencing enables a broad, simultaneous survey of numerous genes and can uncover uncommon genetic alterations in cases where CTNNB1 mutations are not detected.[10,28] However, the clinical implication of these findings requires further research.[28,51]

Differential Diagnosis

When diagnosing jaw fibromatosis, clinicians must consider a wide range of both noncancerous and cancerous conditions, as many can look alike on clinical exam and imaging studies.[8,50] Accurate diagnosis depends on thoughtfully evaluating factors such as the patient's age, the way their symptoms present, the details revealed by imaging, and the microscopic examination of tissue samples.[31,53]

Benign Fibrous Lesions

Fibrous dysplasia represents one of the most important differential diagnostic considerations, particularly in younger patients.[55,56] However, fibrous dysplasia typically demonstrates a characteristic "ground glass" radiographic appearance and lacks the infiltrative histological pattern seen in fibromatosis.[43,56]

Ossifying fibroma and other fibro-osseous lesions may also be considered in the differential diagnosis; however, these lesions typically exhibit well-circumscribed borders and characteristic calcifications.[24,57] The presence of bone or cementum-like calcifications favours ossifying fibroma over aggressive fibromatosis.[58,59]

Malignant Considerations

Low-grade fibrosarcoma represents the most concerning differential diagnosis, requiring careful histological analysis to exclude malignant features.[50,53] The presence of increased mitotic activity, cellular pleomorphism, or necrosis would favour a diagnosis of fibrosarcoma over fibromatosis.[37,53]

Other sarcomas that may rarely occur in the jaw region include synovial sarcoma, malignant peripheral nerve sheath tumour, and rhabdomyosarcoma. Appropriate immunohistochemical panels and molecular studies can help distinguish these entities from fibromatosis.[28,31]

Treatment Strategies and Management Approaches

Evolution of Treatment Paradigms

Over the last twenty years, the treatment of aggressive fibromatosis has evolved considerably. The focus has shifted away from aggressively removing large areas through surgery toward more careful, conservative methods that prioritize preserving the patient's function and overall quality of life.[15,39] This change in treatment approach has been guided by a deeper insight into how the disease naturally progresses, along with the realization that some patients may experience the condition stabilizing or even improving on its own without aggressive intervention.[15,40]

Traditional treatment methods focused on

removing the tumour with wide surgical margins, which often led to considerable loss of function and negatively impacted the patient's quality of life.[13,60] The complex anatomy of the jaw, where removing enough tissue to ensure clear margins can mean taking out important and delicate structures, has made it necessary to explore and adopt different treatment approaches that are less invasive yet effective.[7,13]

Contemporary management approaches recognise aggressive fibromatosis as a chronic disease requiring long-term management rather than a condition necessitating immediate aggressive intervention.[15,40] This perspective has led to the adoption of active surveillance as a first-line management option for many patients, particularly those with asymptomatic or minimally symptomatic disease.[15,40]

Active Surveillance

Active surveillance has emerged as an accepted initial management strategy for selected patients with jaw fibromatosis, particularly those with stable or slowly progressive disease and minimal functional impairment.[15,40] This approach comes from the understanding that in about 20-30% of aggressive fibromatosis cases, the condition can stabilize or even improve on its own without the need for medical or surgical treatment.[15,39]

Implementing active surveillance calls for thoughtful patient selection. It is best suited for individuals who have no symptoms, show stable results on imaging studies, and do not face immediate risks such as airway blockage or other serious, potentially life-threatening problems.[40,45] Regular follow-up through clinical assessments and imaging is crucial to closely watch for any signs that the disease may be progressing and might require starting or adjusting treatment.[15,40]

The emotional effects of choosing active surveillance can be considerable, as patients and their families often face anxiety about whether the disease might worsen. To make this approach work well, it's crucial to communicate clearly, explaining why surveillance is recommended, what the monitoring plan will look like, and the specific signs that would prompt treatment. This transparency helps build trust and eases concerns throughout the ongoing care process.[22,40]

Surgical Management

Surgery remains a crucial treatment option for jaw fibromatosis, although the approach has evolved toward more conservative, function-preserving procedures.[7,13] The goals of surgical intervention include relief of symptoms, prevention of functional compromise, and achievement of local disease control while minimisingmorbidity.[13,60]

Indications for Surgery

Surgical intervention is generally advised for patients who experience symptoms that significantly impair their daily function, show clear evidence of tumour growth with risks of developing serious complications, or who prefer to pursue active treatment rather than continue with observation alone.[7,13] Specific reasons for intervention often include situations where the airway is at risk of being blocked, where the patient faces serious challenges with daily functions, or when cosmetic issues are so pronounced that they significantly affect the person's quality of life.[12,22]

Deciding whether to proceed with surgical intervention requires a careful weighing of the benefits of removing the tumour against the possible risks, such as complications from the surgery and the potential loss of essential functions.[13,17] In the jaw area, these factors become especially complicated because of the close presence of critical nerves and blood vessels, as well as the essential role this region plays in functions like speaking, swallowing, and chewing.[7,22]

Surgical Techniques and Approaches

The surgical approach to jaw fibromatosis must be individualised based on tumour location, size, and relationship to adjacent structures. Mandibular lesions may require various methods, including intraoral, extraoral, or combined techniques, depending on the extent of involvement.[19,23]

Wide surgical margins, traditionally recommended for aggressive fibromatosis, may not be achievable in the jaw region without significant functional compromise.[13.60] Modern treatment strategies focus on thoroughly removing all visible tumour tissue while using additional therapies selectively to target any remaining microscopic disease that might not be evident during surgery.[7,61]

When dealing with larger surgical resections, planning for reconstruction is a vital part of the process. Depending on how extensive the defect is and the specific functional needs of the patient, reconstruction may involve simply closing the wound directly, using nearby tissue to create a local flap, or employing more complex techniques like free tissue transfer.[13,62] The timing of reconstruction may be immediate or delayed, depending on the certainty of diagnosis and completeness of resection.[13,17]

Surgical Outcomes and Complications

Surgical outcomes for jaw fibromatosis are generally favourable when complete resection is achieved, with local control rates of 80-90% reported in most series.[7,13] However, the achievement of negative microscopic margins remains challenging due to the infiltrative growth pattern of these

lesions.[13,61]

Functional outcomes following jaw fibromatosis resection are variable and depend on the extent of resection and quality of reconstruction.[13,22] Common functional concerns include limitations in mouth opening, speech articulation difficulties, and masticatory dysfunction.[12,22]

Complications of surgical treatment may include wound healing problems, infection, nerve injury, and aesthetic deformity.[13,17] Long-term complications, such as growth disturbances in paediatric patients, represent additional concerns that must be considered in treatment planning.[12,21]

Radiation Therapy

Radiation therapy has established efficacy in the treatment of aggressive fibromatosis. It represents an important treatment option for jaw lesions, particularly in cases where surgical resection would result in unacceptable functional morbidity.[61,63] The radiosensitivity of fibroblastic cells provides the biological rationale for this therapeutic approach.[61,64]

Indications and Patient Selection

Radiation therapy can be used in several ways to treat jaw lesions: as the primary treatment when surgical removal isn't possible, as an additional therapy after surgery if the tumour hasn't been completely removed, or as a salvage option for cases where the disease returns. In pediatric patients, however, radiation is typically reserved only for situations where other treatment methods have been tried and found unsuitable. This cautious approach is due to concerns about radiation potentially impairing normal growth and increasing the risk of developing secondary cancers later on. Therefore, radiation in children is applied judiciously, balancing the need to control the disease with the importance of preserving long-term health and development.[63,65]

Choosing who should receive radiation therapy involves thoughtfully weighing several factors: the patient's age, where the tumour is located, its size, any treatments they've already had, and their risk profile.[61,66] The close location of vital structures like the brain, spinal cord, and developing tooth buds in children plays a significant role in shaping treatment choices. Because these areas are so sensitive and crucial for growth and function, clinicians must carefully consider the potential impact on them when planning any intervention.[63,65]

Technical Considerations

Modern radiation therapy methods, such as intensity-modulated radiation therapy (IMRT) and stereotactic body radiation therapy (SBRT), enable exact targeting of tumours. These advanced techniques carefully deliver the necessary radiation dose while minimising damage to surrounding healthy tissues, which helps reduce side effects and improve overall treatment safety and effectiveness.[61,66] These techniques are fundamental in the head and neck region where critical structures are nearby.[61,63]

The optimal radiation dose for aggressive fibromatosis remains somewhat controversial, with most studies reporting doses in the range of 45-60 Gy delivered in conventional fractionation.[61,66] Higher doses may be required for gross residual disease compared to microscopic residual disease following surgical resection [61,67]

Outcomes and Toxicity

Radiation therapy achieves local control rates of 80-95% for aggressive fibromatosis, with results comparable to those achieved with surgical resection.[61,66] The response to radiation therapy may be delayed, with continued tumour regression observed for months to years following treatment completion.[45,63]

Acute radiation toxicity in the jaw region may include mucositis, dermatitis, and temporary taste alterations.[66,68] Long-term side effects of radiation therapy can be prettysevere and often include conditions such as osteoradionecrosis (bone damage caused by radiation), chronic dry mouth (xerostomia), various dental problems, and thickening or scarring of soft tissues (fibrosis). [66,69]

Systemic Therapies

In recent years, the range of systemic treatments for aggressive fibromatosis has grown considerably, offering valuable alternatives for patients whose tumours cannot be surgically removed or who are not suitable for localized treatments.[40,70] These therapies work by addressing different underlying processes of the disease, such as slowing down the growth of abnormal cells, blocking the formation of new blood vessels that feed the tumour, and reducing inflammation that contributes to its progression.[40,71]

Chemotherapy Approaches

Traditional chemotherapy regimens for aggressive fibromatosis, particularly those combining methotrexate and vinblastine, have shown notable effectiveness. Various studies report response rates ranging from 40% to 60%, indicating that these cytotoxic drugs can significantly reduce tumour size or stabilise disease progression in many patients.[7,72] These chemotherapy regimens are generally used for cases where the disease is actively progressing or causing symptoms and cannot be effectively managed with local treatments like surgery or radiation.[7,71]

Low-dose chemotherapy protocols have been developed to minimise toxicity while maintaining therapeutic efficacy.[7,73] The weekly combination of methotrexate and vinblastine has emerged as a promising treatment option for both adult and paediatric patients with aggressive fibromatosis. Clinical studies have shown that this low-dose chemotherapy regimen can effectively control tumour growth, reduce symptoms such as pain, and improve function in affected areas. It is generally well tolerated, with manageable side effects, making it a valuable strategy, especially for cases where surgery is not feasible or the disease is progressive.[7,72]

Targeted Therapies

Discovering abnormal signalling pathways involved in aggressive fibromatosis has paved the way for developing targeted treatments. These therapies aim to specifically interrupt the molecular processes driving tumour growth, offering a more precise and potentially effective approach compared to traditional therapies.[40,70] Tyrosine kinase inhibitors like imatinib, sorafenib, and pazopanib have shown effectiveness in treating aggressive fibromatosis by blocking several key growth factor receptors involved in tumour development. By interfering with these receptors, these drugs help slow down or stop the progression of the disease, offering a targeted approach that addresses the underlying molecular drivers of tumour growth.[71,73]

The recent approval of nirogacestat, a gamma-secretase inhibitor, marks a significant breakthrough in the systemic treatment of aggressive fibromatosis. This novel medication offers a new targeted option that works by interfering with specific cellular pathways involved in tumour growth, providing hope for improved disease control and patient outcomes beyond traditional therapies.[28,40] This medication works by specifically targeting the Notch signalling pathway, and clinical trials have shown that it can significantly extend the time patients live without disease progression, highlighting its potential as an effective treatment option.[40,63]

Hormonal Therapies

Anti-estrogen therapies, including tamoxifen, have been employed in aggressive fibromatosis based on the recognition of hormonal sensitivity in many cases.[7,74] These medications are generally easy for patients to tolerate, making them a promising option for managing hormonally sensitive tumours over extended periods.[7,32]

Determining how long patients should stay on hormonal therapy is still an open question. Some individuals may need to continue treatment indefinitely to keep their disease in check.[7,75] Current evidence regarding endocrine interventions in the paediatric population reflects a cautious approach within the medical community, as researchers and clinicians continue to investigate how these therapeutic approaches may influence the complex processes of childhood growth and developmental milestones.[21,22]

Multimodal Treatment Approaches

The management of aggressive fibromatosis often requires the integration of multiple treatment modalities to optimise outcomes while minimising toxicity.[7,13] The selection and sequencing of different therapies must be individualised based on patient factors, disease characteristics, and response to treatment[13,40]

Combined Surgery and Radiation Therapy

When treating aggressive fibromatosis, doctors have found that combining surgery with follow-up radiation treatment works effectively as a proven treatment strategy. This approach becomes essential when surgeons are unable to completely remove all tumour tissue with clear, healthy borders around the affected area.[61,76] Research suggests that this dual treatment strategy could provide superior control over tumour regrowth in the original location compared to relying on surgery alone or radiation therapy alone.[61,68]

The timing of radiation therapy following surgery is typically within 6-8 weeks of resection to minimise the impact of wound healing on treatment delivery.[61,76] The radiation dose may be adjusted based on the margin status, with higher doses employed for gross residual disease.[61,66]

Integration of Systemic Therapies

Systemic therapies can be integrated with local treatment approaches in various sequences, depending on the clinical scenario.[7,70] Neoadjuvant systemic therapy may be employed to reduce tumour size before surgical resection. Alternatively, doctors may recommend supplementary treatment to eliminate any lingering disease at the cellular level that standard imaging or examination cannot identify.[7,71]

Pairing different systemic medications may create a more powerful treatment effect where the drugs work better together than apart. However, scientists continue to study which combinations are most effective and how to sequence them.[40,73] Healthcare providers must properly maintain vigilant oversight of patient well-being and adverse reactions when implementing combination therapy strategies, as multiple treatments can compound both benefits and risks.[7,71]

Outcomes and Prognosis

Local Control and Recurrence Patterns

The assessment of treatment outcomes in jaw fibromatosis is complicated by the rarity of the condition, the heterogeneous nature of treatment approaches, and the variable follow-up durations reported in the literature.[7,19] However, several general patterns emerge from the available evidence regarding local control and recurrence patterns.[13,60]

Local control rates following complete surgical resection with negative margins range from 85% to 95% in most reported series.[7,19] However, the achievement of negative margins in jaw fibromatosis is often challenging due to the infiltrative growth pattern and anatomical constraints, with positive margins reported in 30-50% of cases.[13,60]

Radiation therapy, either as primary treatment or adjuvant therapy following surgery, achieves local control rates comparable to surgical resection, with 5-year local control rates of 80-95% reported in most series.[61,66] The combination of surgery and radiation therapy may provide superior local control compared to either modality alone, particularly in cases with positive surgical margins.[61,76]

Patterns of Recurrence

Recurrent disease typically manifests within the first 2-3 years following treatment; however, late recurrences beyond 5 years have also been reported.[36,60] The majority of recurrences occur at or near the original tumour site, reflecting the local nature of aggressive fibromatosis.[13,60]

Analysis of patient outcomes reveals that local disease recurrence correlates strongly with three primary variables: residual malignant cells at surgical boundaries, patient age below typical ranges, and tumour measurements exceeding standard thresholds at first clinical presentation.[26,36] Current literature presents mixed evidence regarding the predictive value of distinct CTNNB1 mutation subtypes for tumour recurrence, with research outcomes varying significantly between different patient cohorts and institutional studies.[26,28]

Recurrence management represents one of the most demanding scenarios in oncological practice, with treatment options becoming increasingly limited for patients with prior radiation exposure, where cumulative dose restrictions often preclude further radiotherapy interventions.[60,73] Secondary surgical removal remains a viable option for specific patient subgroups, yet research demonstrates that repeat operations are associated with increased perioperative risks and higher rates of treatment-related complications than first-time surgeries.[13,60]

Functional Outcomes

Functional outcomes are a critical consideration in evaluating treatment success for jaw fibromatosis, given the importance of preserving speech, swallowing, and masticatory function.[12,22] Measuring patient functional performance presents significant methodological challenges, as the scientific community lacks uniform assessment protocols and demonstrates considerable heterogeneity in how functional data is collected and reported across research publications.[13,22]

Speech and Communication

Speech function may be impacted by jaw fibromatosis through several mechanisms, including mechanical interference with tongue mobility, alteration of oral resonance, and dental malocclusion.[12,22] The extent of speech impairment is related to tumour size, location, and the degree of functional compromise at presentation.[12,21]

Treatment-related speech dysfunction may result from surgical resection, particularly when it involves the tongue, floor of the mouth, or mandibular structures.[13,22] Radiation therapy may also impact speech function through effects on salivary gland function and soft tissue fibrosis.[66,68]

Speech rehabilitation and therapy play essential roles in optimising functional outcomes following treatment.[22,77] Early intervention with speech-language pathology services may help minimise long-term functional deficits.[21,22]

Swallowing and Nutrition

Swallowing function may be compromised in patients with jaw fibromatosis due to mechanical obstruction, altered oral phase of swallowing, or disruption of normal anatomical relationships.[12,22] Pediatric patients may be particularly vulnerable to nutritional compromise due to feeding difficulties.[12,21]

Evidence-based swallowing assessment protocols recommend integrating direct clinical observation with objective instrumental measurements, particularly employing video fluoroscopic swallow evaluations in cases where clinical indicators suggest the need for detailed anatomical and functional analysis.[13,22] These evaluation methods enable healthcare teams to pinpoint exact performance limitations and simultaneously collect quantifiable information that guides the design of personalised intervention strategies and treatment selection criteria.[21,22]

Studies demonstrate that supplemental nutrition often becomes essential during therapeutic phases, with particular emphasis on patients experiencing extensive tissue removal operations or high-dose radiation treatments that interfere with regular dietary intake.[13,22] Clinical evidence demonstrates that short-term nutritional support via feeding tubes may be indicated for patients experiencing inadequate oral intake during acute illness. This intervention prevents

nutritional deterioration and supports physiological stability while patients recover from their primary condition.[13,21]

Masticatory Function

Masticatory function may be impaired through several mechanisms, including limitations in mouth opening (trismus), dental malocclusion, and loss of masticatory muscle function.[12,22] Contemporary neuroscience research demonstrates that functional recovery outcomes are determined by three interconnected factors: anatomical lesion location, injury volume, and therapeutic intervention strategy.[13,22]

The restoration of masticatory function may require comprehensive rehabilitation, including dental restoration, orthodontic treatment, and prosthodontic reconstruction.[13,22] Some treatments or therapies might be postponed until the disease is better managed and any side effects from earlier treatments have settled down.[13,17]

Research indicates that persistent masticatory impairments often result in altered food choices and reduced intake of essential nutrients. Such nutritional compromises highlight the clinical need for comprehensive functional evaluation and targeted rehabilitation strategies.[13,22]

Quality of Life Outcomes

Quality of life represents an increasingly important outcome measure in the management of aggressive fibromatosis, particularly given the benign nature of the disease and the chronic nature of the management required for many patients.[3,36] Assessing quality of life in patients with jaw fibromatosis is challenging because there are no measurement tools specifically designed for this condition. The effects of treatment can vary widely across different aspects of life.[36,40]

Physical Function and Symptoms

Physical function can be compromised through multiple pathways, including persistent pain, activity limitations, and treatment-induced complications.[22,36] Pain is consistently identified in clinical research as a significant determinant of quality of life outcomes. Quantitative analyses reveal that patients experiencing pain score significantly lower on standardised quality of life measures, such as the SF-36 and EQ-5D, compared to pain-free counterparts.[36,40]

The management of pain in patients with jaw fibromatosis may require multimodal approaches, including pharmacological interventions, physical therapy, and psychological support.[22,36] The role of pain management specialists may be important in optimising comfort and function.[13,40]

Treatment-related symptoms such as radiation-induced xerostomia, surgical scarring, and functional limitations may have persistent impacts on quality of life.[66,68] Integrating supportive care services across the entire treatment continuum has been shown to mitigate symptom burden, functional decline, and psychosocial distress.[13,22]

Psychological and Social Impact

The psychosocial burden of jaw fibromatosis is often significant, with younger patients being particularly vulnerable due to the combined effects of facial disfigurement and associated functional impairments.[12,36] The prolonged course of chronic illnesses, combined with unpredictable long-term prognoses, has been identified as a significant psychosocial stressor.[3,36]

Social functioning may be impaired through various mechanisms, including speech difficulties, eating limitations, and self-consciousness about appearance.[22,36] Research shows that certain health-related factors carry heightened importance during adolescence, a period marked by rapid growth and psychological change.[12,22]

Research shows that providing access to psychological care, including professional counselling and peer-led support groups, can improve overall well-being for individuals affected by jaw fibromatosis.[22,36] Research in oncology, rehabilitation, and chronic illness management consistently shows that early screening for psychological distress-followed by prompt, targeted intervention-can lead to better patient-reported outcomes, higher treatment adherence, and improved quality of life scores.[13,21]

Long-term Survival and Outcomes

Long-term outcomes for jaw fibromatosis are highly favourable, with reported survival rates nearing 100%-a reflection of the benign biological behaviour of these lesions. While local recurrence can occur, particularly if excision margins are inadequate, mortality is virtually nonexistent.[3,7] Despite its benign nature, jaw fibromatosis carries a risk of substantial morbidity due to potential local progression and treatment-related complications, such as functional impairment or disfigurement.[13,36]

Growth and Development Considerations

Paediatric patients with jaw fibromatosis require special consideration regarding the potential impact of both disease and treatment on normal growth and development.[12,21] The jaw region is significant for facial growth, dental development, and functional maturation.[12,22]

Treatment-related growth disturbances may

result from surgical resection involving growth centres, radiation therapy effects on developing tissues, or prolonged systemic therapies during critical growth periods.[21,65] The long-term monitoring of growth parameters is essential in paediatric patients.[12,21]

The timing of treatment interventions may need to be coordinated with typical developmental milestones to optimise long-term outcomes.[12,21] Research highlights the importance of a multidisciplinary team, including pediatric subspecialists, when managing children with complicated health needs.[12,21]

Secondary Malignancy Risk

The long-term risk of secondary malignancy following treatment for jaw fibromatosis is considered low, reflecting the predominantly benign nature of the disease. But requires consideration, particularly in patients receiving radiation therapy.[65,66].The latency period for radiation-induced malignancies typically ranges from 10 to 20 years post-radiotherapy. This prolonged interval underscores the critical need for sustained, long-term surveillance in patients who have undergone radiation treatment, enabling timely detection and management of secondary cancers.[66,69]

The risk of secondary malignancy must be balanced against the benefits of radiation therapy in achieving local disease control.[65,66] In paediatric populations, the relevance of this consideration is heightened due to their extended life expectancy and the correspondingly increased potential for late-onset complications[65,69]

Future Directions and Research Opportunities

Molecular Therapeutics and Precision Medicine

Recent advances have identified key molecular alterations, such as mutations in the APC gene and β-catenin (CTNNB1), that contribute to the pathogenesis of aggressive fibromatosis.[19,28] The predominance of CTNNB1 mutations, especially at codons such as T41A and S45F, and the resulting dysregulation of the Wnt/β-catenin signalling pathway, are key molecular features driving aggressive fibromatosis.[11,40]

Novel therapeutic approaches targeting the Wntsignalling pathway are in various stages of development, including small-molecule inhibitors of β-catenin/TCF interactions and modulators of downstream signalling components.[40,63] The successful clinical development and FDA approval of nirogacestat, a selective gamma secretase inhibitor, demonstrate the feasibility of targeting downstream components of the Wnt/β-catenin signalling pathway in desmoid tumours.[28,40]

The molecular landscape of aggressive fibromatosis is notably heterogeneous, encompassing variations such as distinct CTNNB1 mutation subtypes and APC gene alterations, each influencing disease behaviour and treatment responsiveness.[19,28] The advancement of comprehensive genomic profiling (CGP) techniques enables the systematic analysis of tumour DNA to detect a broad spectrum of genomic alterations.[28,51]

Biomarker Development

The ongoing search for reliable biomarkers that forecast treatment effectiveness and clinical outcomes is at the forefront of medical research.[26,28] While CTNNB1 mutations are present in the majority of cases, the relationship between specific mutation types and clinical behaviour remains unclear.[26,28]

The development of circulating biomarkers that can be used for disease monitoring and assessing treatment response represents another vital research direction.[28,48] Validated biomarkers have the potential to serve as reliable, non-invasive surrogates for disease monitoring, thereby reducing reliance on serial imaging and repeated tissue sampling.[28,51]

Gene expression profiling has the potential to refine the classification of aggressive fibromatosis by identifying additional molecular subtypes with distinct biological behaviour, prognostic implications, and therapeutic sensitivities.[18,28] Such studies have the potential to elucidate the biological and molecular mechanisms that contribute to the diverse clinical manifestations observed in these lesions.[28,51]

Advanced Therapeutic Approaches

Emerging treatment modalities for aggressive fibromatosis encompass a range of innovative options, such as minimally invasive ablative procedures (e.g., radiofrequency or cryoablation), novel immunotherapeutic interventions designed to enhance anti-tumour immunity, and integrative regimens combining agents that target distinct molecular pathways.[39,48] Innovative therapeutic strategies may broaden management possibilities for individuals with refractory disease or those deemed unsuitable for standard interventions due to comorbidities, toxicity risks, or anatomical constraints.[48,49]

Ablative Techniques

Minimally invasive ablative techniques, including cryoablation, radiofrequency ablation, and high-intensity focused ultrasound, have shown promise in treating aggressive fibromatosis.[39,48] Minimally invasive and targeted therapeutic modalities may offer substantial benefit for lesions situated in anatomically complex regions where conventional surgical resection carries a high risk of

morbidity, such as functional impairment, neurological deficits, or significant cosmetic deformity.[42,48]

While experience with ablative techniques in jaw fibromatosis is currently limited, their use may be particularly advantageous for tumours adjacent to critical anatomical structures where traditional surgical resection would pose significant risks of morbidity.[39,48] Further research is needed to establish the safety and efficacy of these techniques in the craniofacial region.[42,48]

Combination Therapies

The combination of different therapeutic modalities may provide synergistic effects and improved outcomes compared to single-agent approaches.[49,70] Clinical trials are actively evaluating rational combination strategies that leverage complementary mechanisms of action to enhance therapeutic efficacy and overcome treatment resistance.[40,73]

The integration of molecularly targeted agents with established treatment modalities, such as surgical resection and radiation therapy, is emerging as a promising avenue in aggressive tumour management.[40,61] Combination or multimodal strategies have the potential to permit dose de-escalation of individual therapeutic components without compromising, and in some cases enhancing, overall efficacy.[40,71]

Paediatric Considerations and Specialised Approaches

The management of paediatric patients with jaw fibromatosis presents unique challenges that require specialised research attention.[12,21] The impact of treatment on growth and development, the different natural history in paediatric populations, and the need for family-centred care approaches require dedicated investigation.[21,22]

Growth and Development Research

Long-term studies examining the impact of various treatment approaches on facial growth and development are necessary to optimise management strategies for paediatric patients.[12,21] Future research should comprehensively evaluate the effect of both disease pathology and therapeutic interventions on normal developmental trajectories.[21,22]

Developing paediatric-specific treatment protocols that integrate developmental needs alongside therapeutic effectiveness is a key research priority.[2,22] These protocols should incorporate input from paediatric specialists across multiple disciplines.[12,21]

Family-Centred Care Models

Research examining optimal models of care delivery for paediatric patients and their families is needed to improve overall outcomes and quality of life.[2,22] These studies should examine the effectiveness of different support services and care coordination approaches.[13,22]

The psychological impact of jaw fibromatosis on paediatric patients and families requires dedicated research attention, with the development of evidence-based interventions to address these needs.[12,36] The long-term psychological outcomes of different treatment approaches should be systematically evaluated.[22,36]

Technology Integration and Digital Health

The integration of advanced technologies-including AI algorithms, machine learning models, and digital health systems-holds promise for enhancing the diagnostic precision and management strategies of jaw fibromatosis.[28,51] These technologies may be particularly valuable given the rarity of the condition and the need for specialised expertise.[42,51]

Diagnostic Enhancement

The application of machine learning algorithms to imaging datasets offers the potential to enhance diagnostic accuracy for jaw fibromatosis and other soft tissue lesions.[42,79] Advanced diagnostic approaches-such as high-resolution imaging, radiomic analysis, and molecular profiling-may be particularly valuable in differentiating aggressive fibromatosis from other fibro-osseous and fibrous lesions of the jaw.[42,51]

The emergence of AI-enabled digital pathology platforms offers the potential to improve diagnostic reproducibility and accuracy while facilitating remote access to subspecialty expertise.[28,51] AI-driven digital pathology solutions provide the capability to unify data sharing and collaboration among multiple research centres.[51,79]

Treatment Monitoring and Follow-up

The adoption of digital health platforms provides a practical framework for sustained monitoring and follow-up in patients with jaw fibromatosis, a condition known for its chronic course and potential for recurrence.[36,40] Digital health platforms have the potential to streamline longitudinal monitoring of symptom progression, functional status, and therapeutic response.[40,78]

Incorporating patient-reported outcome measures (PROMs) into digital health platforms enables a more holistic evaluation of therapeutic efficacy, capturing both clinical benefits and patient-perceived changes in quality of life.[36,40] The analysis

of these data can guide evidence-informed treatment planning, enabling clinicians to tailor therapeutic strategies to individual patient profiles.[22,40]

CONCLUSION[1-79]

Aggressive fibromatosis of the jaw represents a rare but clinically significant neoplasm that poses unique diagnostic and therapeutic challenges within the maxillofacial region. The molecular characterisation of aggressive fibromatosis, particularly the identification of CTNNB1 mutations and aberrant Wnt/β-catenin signalling, has provided important insights into disease pathogenesis and opened new avenues for targeted therapeutic interventions. The nuclear accumulation of β-catenin protein serves as both a diagnostic marker and a potential therapeutic target, with implications for precision medicine approaches. The clinical management of jaw fibromatosis has evolved significantly from historical approaches emphasising aggressive surgical resection toward more conservative, function-preserving strategies. The recognition that a substantial proportion of patients may experience disease stabilisation or regression has led to the adoption of active surveillance as a viable initial management approach for selected patients. This paradigm shift reflects an improved understanding of the natural history of the disease and an emphasis on preserving quality of life. Contemporary treatment approaches must balance the goals of disease control with preservation of critical functions, including speech, swallowing, and mastication. The anatomical constraints of the maxillofacial region often preclude the achievement of wide surgical margins traditionally recommended for aggressive fibromatosis, necessitating the integration of multiple treatment modalities, including surgery, radiation therapy, and systemic therapies. The outcomes for patients with jaw fibromatosis are generally favourable, with excellent long-term survival rates reflecting the benign nature of these lesions. However, the potential for significant functional morbidity and impact on quality of life requires careful attention to rehabilitation and supportive care services. Pediatric patients require special consideration regarding the potential effects on growth and development, with long-term monitoring essential to optimise outcomes. Several key research directions have been identified, including the development of novel targeted therapies based on molecular insights, the investigation of minimally invasive treatment approaches, and the optimisation of pediatric management strategies. The integration of advanced technologies, including artificial intelligence and digital health platforms, may enhance diagnosis and management capabilities. The rarity of jaw fibromatosis presents ongoing challenges for clinical research, emphasising the importance of collaborative multi-institutional studies and international registries to advance understanding and improve patient outcomes. The development of standardised outcome measures and treatment protocols will be crucial to facilitating a meaningful comparison of different therapeutic approaches. Future investigations should focus on identifying biomarkers predictive of clinical behaviour and treatment response, developing precision medicine approaches based on molecular profiling, and optimising quality of life outcomes through comprehensive, multidisciplinary care models. The continued evolution of treatment paradigms toward personalised, function-preserving approaches holds promise for further improving outcomes for patients with this challenging condition. In conclusion, aggressive fibromatosis of the jaw requires expert multidisciplinary management with careful consideration of individual patient factors, disease characteristics, and treatment goals. While significant advances have been made in understanding and treating this condition, continued research efforts are essential to optimise outcomes and develop more effective, less toxic therapeutic approaches for affected patients and their families.

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