

Clinicopathological Spectrum and Management of Aneurysmal Bone Cysts in Atypical Anatomical Location: A Comprehensive Review of Demographics, Presentation, Diagnosis, and Treatment Outcomes

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Learning Point of the Article:

Aneurysmal bone cysts demonstrate a broad clinicopathological spectrum, and successful management requires accurate diagnosis, differentiation from malignant mimics, and a treatment strategy tailored to lesion location, aggressiveness, and patient factors.

Abstract

Introduction: Aneurysmal bone cysts (ABCs) are benign but locally aggressive osteolytic lesions characterized by blood-filled cystic spaces separated by fibrous septa containing osteoclast-like giant cells and reactive bone. Although commonly affecting the metaphysis of long bones in children and adolescents, ABCs may occur in atypical anatomical locations, creating diagnostic and therapeutic challenges. The aim of this study was to review the demographic characteristics, clinical presentation, radiological and histopathological features, diagnostic challenges, and current management strategies of atypically presenting ABCs.

Materials and Methods: A narrative review was performed using articles published in the Journal of Orthopaedic Case Reports from 2011 to 2026. Forty-two records were initially identified (41 case reports and 1 case series); 15 were excluded after initial screening, and 10 additional reports were excluded at full-text assessment because they described conventional metaphyseal ABCs, leaving 17 reports (16 case reports and 1 case series) for the atypical-location review. Because this was a narrative review restricted to a single journal, no pooled effect estimates or formal comparative treatment conclusions were attempted.

Results: ABCs predominantly occur during the first two decades of life and commonly involve the distal femur, proximal tibia, proximal humerus, and spine. Pain and swelling are the most frequent presenting symptoms. Radiographs typically demonstrate expansile osteolytic lesions with a multiloculated appearance, while magnetic resonance imaging frequently reveals fluid-fluid levels. Histologically, lesions consist of blood-filled spaces, fibroblastic septa, osteoclast-like giant cells, and reactive woven bone. Management options include curettage with bone grafting, sclerotherapy, en bloc resection, and reconstruction depending on lesion location and aggressiveness. Recurrence rates vary between 10% and 30%, with lower recurrence following complete excision.

Conclusion: ABCs exhibit a wide clinicopathological spectrum. In atypical anatomical locations, diagnosis requires careful clinicoradiological correlation and histopathological confirmation. Management should be individualized according to lesion biology, anatomical constraints, skeletal maturity, and functional requirements; however, treatment effectiveness and recurrence rates cannot be established reliably from the predominantly case-report-based evidence reviewed here.

Keywords: Aneurysmal bone cyst, atypical location, benign bone tumor, giant cell lesion, sclerotherapy, curettage, orthopedic oncology.

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Introduction

Aneurysmal bone cyst (ABC) is an uncommon benign but locally aggressive osteolytic bone lesion characterized by blood-filled cystic spaces separated by connective tissue septa containing fibroblasts, multinucleated giant cells, and reactive woven bone [1]. First described by Jaffe and Lichtenstein in 1942, ABC has since been recognized as a distinct clinicopathological entity that can exhibit aggressive behavior despite its benign histological nature. Although ABC accounts for only approximately 1% of all primary bone tumors, its propensity for rapid expansion, cortical destruction, pathological fracture, and recurrence makes it a clinically significant condition in Orthopaedic oncology [2].

ABCs predominantly affect children and adolescents, with nearly 80% of cases occurring during the first two decades of life. The lesion most commonly arises in the metaphyseal regions of long bones, particularly the distal femur, proximal tibia, and proximal humerus, as well as the posterior elements of the spine [3]. However, ABCs have been reported in virtually every skeletal site, including uncommon locations such as the pelvis, clavicle, scapula, ribs, talus, calcaneum, metatarsals, craniofacial bones, and small bones of the hands and feet [4]. Lesions arising in atypical locations frequently pose diagnostic and therapeutic challenges because of their rarity and the broad range of differential diagnoses.

Historically, the pathogenesis of ABC was attributed to local circulatory disturbances resulting in increased venous pressure, vascular dilatation, and progressive bone resorption [5]. Advances in molecular pathology have substantially improved the understanding of this lesion. Recurrent chromosomal translocations involving the USP6 oncogene have been identified in primary ABCs, supporting the concept that these lesions represent true neoplasms rather than purely reactive processes [6]. In contrast, secondary ABCs develop within pre-existing osseous lesions such as giant cell tumors, chondroblastoma, osteoblastoma, fibrous dysplasia, and non-ossifying fibroma. This distinction has important implications for diagnosis, biological behavior, and treatment planning.

The clinical presentation of ABC is highly variable and depends on lesion size, anatomical location, and biological aggressiveness. Pain and swelling are the most common presenting complaints, although patients may also present with a palpable mass, deformity, restricted joint motion, neurological symptoms in spinal lesions, or pathological fractures. The nonspecific nature of these symptoms often leads to delayed diagnosis, particularly in uncommon anatomical sites.

Radiological evaluation plays a crucial role in the diagnostic workup. Conventional radiographs typically demonstrate an

expansile, eccentric, osteolytic lesion with cortical thinning and the characteristic “multiloculated” appearance [2]. Computed tomography (CT) assists in assessing cortical integrity and surgical planning, whereas magnetic resonance imaging (MRI) frequently reveals multiloculated cystic cavities with fluid–fluid levels, a feature considered highly suggestive of ABC. Nevertheless, these imaging findings are not pathognomonic, and several lesions, including telangiectatic osteosarcoma, giant cell tumor (GCT), unicameral bone cyst, and chondroblastoma, may demonstrate overlapping radiological features. Consequently, histopathological examination remains the gold standard for definitive diagnosis.

Management of ABC has evolved considerably over the past few decades. Traditional treatment consisted primarily of intralesional curettage with or without bone grafting; however, recurrence rates ranging from 10% to 30% prompted the development of adjunctive techniques and alternative treatment modalities. Contemporary management options include extended curettage, high-speed burring, adjuvant local therapies, percutaneous sclerotherapy, selective arterial embolization, en bloc resection, and various reconstructive procedures. The optimal treatment strategy depends on patient age, lesion location, extent of bone destruction, proximity to neurovascular structures, and risk of recurrence [2,7].

Given the wide spectrum of clinical presentations, anatomical locations, and available treatment options, a comprehensive understanding of the epidemiology, pathogenesis, diagnostic characteristics, and management strategies of ABC is essential for Orthopaedic surgeons, musculoskeletal radiologists, pathologists, and oncologists. This review aims to summarize the current evidence regarding the demographics, clinical presentation, radiological and histopathological features, differential diagnosis, treatment modalities, and outcomes of ABCs, while highlighting the challenges associated with atypical presentations and contemporary management approaches.

Materials and Methods

Study design

This study was conducted as a narrative review of published literature on ABCs, with particular emphasis on demographic characteristics, clinical presentation, anatomical distribution, diagnostic features, histopathology, treatment modalities, and clinical outcomes. The review aimed to provide a comprehensive overview of the clinicopathological spectrum of ABCs, including both typical and atypical presentations reported in the literature.

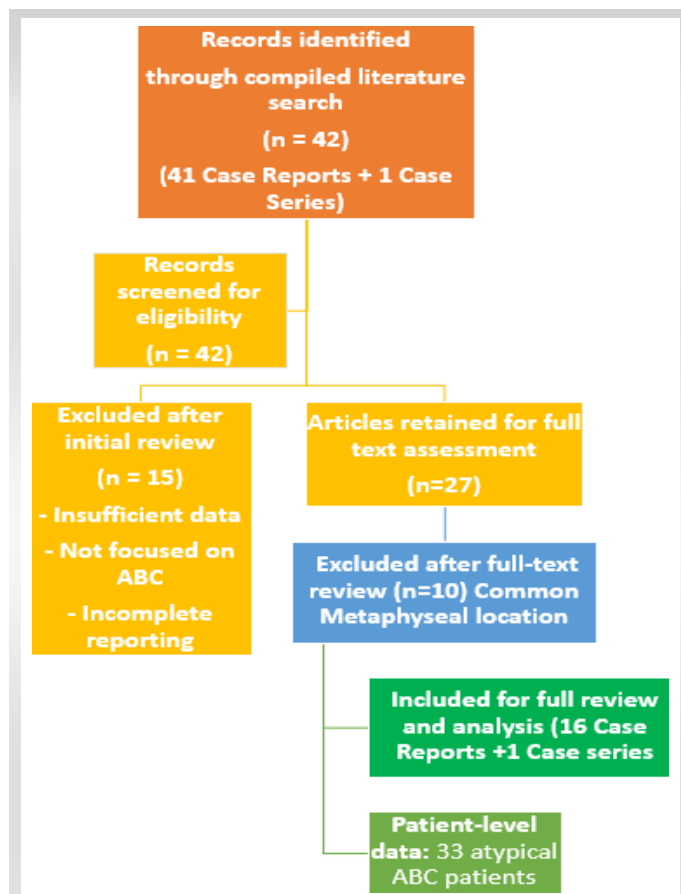


Figure 1: Flow diagram demonstrating the study selection process.

Literature source

The review was based on published case reports and case series pertaining to ABCs in atypical anatomical locations in the Journal of Orthopaedic Case Reports from 2011 to 2026. The compiled literature included reports of ABCs occurring in both common ($n = 10$) and uncommon anatomical locations ($n = 17$), such as long bones, pelvis, clavicle, spine, foot, and other rare skeletal sites (Fig. 1).

Eligibility criteria

Studies were considered eligible for inclusion if they:

- Reported patients with histologically confirmed ABCs
- Described demographic characteristics, clinical presentation, imaging findings, pathology, management, or outcomes
- Included primary or secondary ABCs affecting atypical skeletal location
- Were available in full text and published in the English language.

Studies were excluded if they:

- Lacked histopathological confirmation of diagnosis

- Contained insufficient clinical or radiological information
- Described the long bone metaphyseal ABC.

Study-selection clarification

The apparent discrepancy between 42, 27, and 21 reports reflects sequential screening stages. Forty-two records were initially identified; 15 were excluded during initial screening, leaving 27 for full-text assessment. Ten of these were excluded because they described conventional metaphyseal long-bone ABCs, leaving 17 reports (16 case reports and 1 case series) focused on atypical locations. The 33 patients represent the patient-level aggregate reported within these 17 included publications; therefore, article counts and patient counts should not be interpreted interchangeably.

Data synthesis

This review was designed as a narrative review. The literature search was restricted to Journal of Orthopaedic Case Reports (JOCR), and therefore the findings should be interpreted as a focused synthesis of reports published in that journal. The original search did not use PubMed/MEDLINE, Embase, Scopus, Web of Science, or the Cochrane Library; consequently, a comprehensive database search strategy, Boolean search string, and database-specific search dates cannot be retrospectively reported as having been performed.

Extracted data were analyzed descriptively and synthesized narratively. The collected evidence was compared with established Orthopaedic oncology literature to identify common patterns, emerging trends, and areas of clinical importance.

Ethical considerations

As this study was a review of previously published literature and did not involve direct patient recruitment, intervention, or access to identifiable patient information, institutional ethical approval and informed consent were not required.

Results

ABCs occurring outside the metaphysis of long bones represent a diagnostically challenging subset of lesions. Foot bones, pelvis, spine, clavicle, ribs, and craniofacial bones were the most commonly reported atypical sites. While imaging characteristics remained similar to conventional ABCs, atypical location substantially broadened the differential diagnosis and often necessitated advanced imaging and histopathological confirmation. Surgical treatment tailored to anatomical location achieved excellent functional outcomes and low

Table 1: Analysis of aneurysmal bone cysts in atypical locations

No.	Site	Clinical presentation	Diagnostic approach	Differential diagnosis	Management	Outcome and follow-up
1	Lateral Cuneiform	Midfoot pain, swelling, difficulty walking, pathological fracture	X-ray, CT, MRI, biopsy	Chondromyxoid fibroma, GCT, osteoblastoma	<i>En bloc</i> excision+tricortical iliac crest graft+arthrodesis	Complete union, pain-free walking, no recurrence
2	Talus	Chronic ankle pain, swelling, gait disturbance	Radiographs, MRI, histopathology	Chondroblastoma, GCT, telangiectatic osteosarcoma	Curettage+bone grafting	Good function, no recurrence reported
3	Calcaneum	Heel pain, swelling, difficulty weight-bearing	X-ray, MRI, biopsy	Unicameral bone cyst, GCT, chondroblastoma	Curettage+grafting	Radiological healing and symptom resolution
4	Third Metatarsal	Progressive foot swelling and pain	X-ray, MRI, biopsy	Enchondroma, osteomyelitis, GCT	<i>En bloc</i> excision+fibular strut graft	Excellent functional outcome, no recurrence
5	Clavicle	Painful enlarging clavicular mass	X-ray, CT, MRI, biopsy	Eosinophilic granuloma, plasmacytoma, GCT	Wide/ <i>en bloc</i> excision	Full shoulder function, no recurrence
6	Acetabulum/Pelvis	Hip pain, limp, reduced range of motion	X-ray, CT, MRI, biopsy	Chondrosarcoma, metastatic lesion, GCT	Curettage±reconstruction	Preserved hip function, no recurrence reported
7	Ilium/Iliac Bone	Pelvic pain and swelling	CT, MRI, biopsy	Fibrous dysplasia, giant cell tumor, sarcoma	Surgical excision/curettage	Good local control
8	Rib	Chest wall swelling and pain	CT, MRI, histopathology	Fibrous dysplasia, chondrosarcoma, metastasis	Wide excision	No recurrence during follow-up
9	Distal Ulna	Wrist pain and swelling	X-ray, MRI, biopsy	Osteoblastoma, GCT	Wide excision	No recurrence reported
10	Sphenoid Wing/Craniofacial Skeleton	Headache, facial asymmetry, orbital symptoms	CT, MRI, histopathology	Fibrous dysplasia, giant cell lesion, osteoblastoma	Surgical excision	Symptomatic improvement, no recurrence
11	Lumbar Spine (L3 vertebra)	Acute paraparesis, lower limb weakness, severe pain, gait inability in pregnancy	MRI showing multiloculated lesion with fluid-fluid levels, biopsy confirmation	Transverse myelitis, multiple sclerosis, metastatic lesion, Guillain-Barré syndrome, spinal epidural abscess	Staged decompression, tumor excision, pedicle screw fixation, cage reconstruction	Independent ambulation at 10 months follow-up
12	Tibial Diaphysis	Pain, swelling, cortical expansion	X-ray, MRI, histopathology	Fibrous dysplasia, adamantinoma, osteofibrous dysplasia	Wide excision+ipsilateral fibular strut graft	Excellent functional and radiological outcome at 1 year; no recurrence

CT: Computed tomography, MRI: Magnetic resonance imaging, GCT: Giant cell tumor

recurrence rates, particularly when complete excision was feasible.

Aggregate analysis of atypical ABCs

Number of Articles:

- 20 individual case reports
- 1 Case series
- Total atypical ABC cases reviewed: 33 patients.

The following table synthesized the available data from the reviewed articles (Table 1).

Anatomical distribution of atypical ABCs

The reviewed literature demonstrated a wide anatomical distribution of atypical ABCs involving both appendicular and axial skeletal sites outside the conventional metaphyseal regions of long bones. The foot represented the most frequently affected region, with lesions reported in the talus ($n = 2$), calcaneum ($n = 3$), cuneiform bones ($n = 2$), navicular ($n = 1$), and metatarsals ($n = 2$). Pelvic involvement included the ilium ($n = 2$), acetabulum ($n = 1$), and pubic rami ($n = 1$). Lesions affecting the axial skeleton were identified in the lumbar

vertebrae ($n = 2$), cervical vertebra ($n = 1$), and sacroiliac joint ($n = 1$). In the upper limb, atypical ABCs were reported in the clavicle ($n = 2$), metacarpals ($n = 2$), distal ulna ($n = 1$), radial head ($n = 1$), and scapular glenoid ($n = 1$). Additional uncommon sites included the rib ($n = 1$) within the thoracic cage and the sphenoid wing ($n = 1$) within the craniofacial skeleton. Lower-limb lesions outside the typical metaphyseal location involved the patella ($n = 2$), tibial diaphysis ($n = 1$), femoral head ($n = 1$), femoral shaft ($n = 1$), and femoral neck ($n = 1$). Overall, the foot and pelvic regions constituted the largest proportion of atypical ABCs, highlighting the diverse anatomical spectrum and diagnostic complexity associated with these uncommon presentations.

Common clinical presentations

Overall, the clinical presentation of atypical ABCs was largely determined by lesion location and extent of local bone involvement, although pain and swelling remained the most consistent presenting features across all reported cases. A palpable mass was observed in several cases, particularly in superficial locations such as the clavicle, rib, and foot bones. Patients with lesions involving the pelvis and foot commonly presented with limping, gait disturbances, or difficulty bearing



Table 2: Demographic profile of atypical ABCs in comparison to literature

Parameter	Standard literature	Findings in this study
Age	Usually <20 years; peak in 2 nd decade	Majority pediatric/adolescent cases; age range 5–45 years in atypical series
Sex	Slight female predominance or equal distribution	11 males and 9 females in atypical series
Incidence	~1% of all bone tumors	Repeatedly cited throughout articles
Common Sites	Distal femur, proximal tibia, proximal humerus, spine	Several uncommon sites reported: talus, calcaneum, clavicle, sphenoid wing, metatarsal, acetabulum, ulna, rib, femoral neck
Primary versus Secondary	Primary ~70–80%; Secondary ~20–30%	Secondary ABC associated with chondroblastoma, fibrous dysplasia, giant cell tumor, metabolic lesions
ABCs: Aneurysmal bone cysts		

weight due to pain and structural compromise of the affected bone. Pathological fractures were encountered occasionally, particularly in lesions associated with extensive cortical thinning or aggressive bone destruction. Neurological deficits were uncommon and were primarily restricted to spinal ABCs, where tumor expansion resulted in neural compression, manifesting as lower-limb weakness, sensory disturbances, or

gait impairment.

Diagnostic strategy

Nearly all articles depicted a similar diagnostic pathway: Plain radiographs, CT scan, MRI, Histopathological confirmation.

Differential diagnosis

The diagnosis of ABCs in atypical skeletal locations is often challenging because of significant overlap with several benign and malignant bone lesions. In the foot, particularly in lesions involving the talus and calcaneum, the most common differential diagnoses include GCT and chondroblastoma, both of which may demonstrate expansile osteolytic features and similar MRI characteristics. Pelvic lesions frequently raise suspicion for GCT, metastatic disease, brown tumor of hyperparathyroidism, and telangiectatic osteosarcoma because of their aggressive radiographic appearance and extensive bone destruction. ABCs involving the clavicle may mimic GCT or eosinophilic granuloma, whereas lesions affecting the spine often necessitate

differentiation from telangiectatic osteosarcoma and osteoblastoma because of their expansile nature and potential neurological manifestations. Craniofacial lesions, particularly those involving the sphenoid wing, may resemble fibrous dysplasia or other giant cell-rich lesions. Similarly, rib lesions are commonly confused with fibrous dysplasia or chondrosarcoma. The presence of fluid–fluid levels on MRI may strongly suggest ABC; however, histopathological confirmation remains essential to exclude these important differential diagnoses and establish a definitive diagnosis.

Management patterns

Treatment strategies for atypical ABCs are largely determined by the anatomical location of the lesion, extent of bone involvement, functional demands of the affected region, and risk of recurrence. Lesions involving the foot bones, including the talus, calcaneum, cuneiforms, and

Table 3: Comparison of atypical ABCs in this review with standard orthopaedic oncology literature

Parameter	Atypical ABCs from your documents	Standard orthopaedic oncology literature
Age	Predominantly children, adolescents, and young adults; occasional adult cases	Approximately 80% occur before 20 years of age
Location	Foot (talus, calcaneum, cuneiform, metatarsal), clavicle, rib, pelvis, acetabulum, sphenoid wing, distal ulna, spine	Most commonly metaphysis of long bones and posterior elements of spine; atypical sites are uncommon but recognized
Presentation	Pain, swelling, limp, pathological fracture, neurological deficit (spine)	Pain and swelling remain the most common symptoms; pathological fractures and neurological deficits occur in aggressive lesions
Diagnostic Difficulty	Frequently mistaken for GCT, chondroblastoma, sarcoma, fibrous dysplasia, metastasis	Diagnostic confusion is well recognized, especially with telangiectatic osteosarcoma and giant cell tumor
MRI Findings	Fluid-fluid levels reported in nearly all atypical lesions	Fluid-fluid levels considered highly suggestive but not pathognomonic
Histopathology	Blood-filled spaces, fibroblastic septa, giant cells, reactive bone	Identical classical histological description in standard literature
Treatment	Curettage, grafting, wide excision, arthrodesis, reconstruction, spinal stabilization	Curettage with grafting remains standard treatment; adjuvants increasingly used
Recurrence	Recurrence was infrequently reported; rates cannot be estimated reliably	Recurrence rates generally 10–30%, especially after intralesional procedures
Functional Outcome	Favorable outcomes were commonly described, but reporting was non-standardized	Excellent when local control achieved
Follow-up	Usually 10 months–5 years	Most recurrences occur within the first 2 years after treatment
ABCs: Aneurysmal bone cysts, GCT: Giant cell tumor, MRI: magnetic resonance imaging		

metatarsals, were most commonly treated with intralesional curettage and bone grafting, although en bloc excision with structural reconstruction was preferred in cases associated with extensive bone destruction. ABCs arising in relatively expendable bones such as the clavicle, rib, and distal ulna were generally managed by wide excision, which provided excellent local control with minimal functional compromise. Pelvic lesions were commonly treated with extended curettage with or without reconstruction depending on the extent of acetabular or pelvic involvement. Spinal ABCs often required a combination of neural decompression, complete or subtotal tumor excision, and instrumented stabilization to restore spinal stability and neurological function. Craniofacial lesions were managed primarily by surgical excision, whereas diaphyseal lesions frequently required wide excision followed by structural graft reconstruction to restore skeletal integrity. Overall, treatment selection was individualized according to lesion location and anticipated biomechanical consequences.

Outcomes and follow-up

Most individual reports described favorable local disease control and functional recovery after definitive treatment. However, these observations cannot be generalized to all atypical ABCs because the evidence consisted predominantly of case reports and one case series, with heterogeneous follow-up and non-standardized functional outcomes.

Discussion

ABCs remain one of the most intriguing benign skeletal lesions encountered in Orthopaedic oncology because of their variable biological behavior, diverse anatomical distribution, and potential to mimic aggressive neoplastic conditions. The

findings synthesized in this review largely corroborate the established Orthopaedic oncology literature while also emphasizing the demographic profile, diagnostic and therapeutic challenges associated with atypical presentations (Tables 2 and 3).

Site-Specific comparison in literature reveal that foot ABCs are exceptionally rare in large Orthopaedic oncology series. Most major series reported very few lesions in the tarsal bones [5]. Consequently, diagnosis is often delayed because clinicians initially suspect more common foot tumors. Our collection contains a disproportionately high number of foot ABCs compared with classical Orthopaedic oncology series, making it particularly valuable for understanding rare-site disease.

The 2023 review identifies pelvic ABCs as among the most difficult lesions to manage because of large size at presentation, difficult surgical access and significant intraoperative bleeding risk. Selective arterial embolization is often recommended for pelvic lesions and may achieve local control rates approaching 94%. None of our reviewed cases used embolization as primary treatment despite its strong support in Orthopaedic oncology literature [8].

Spinal ABCs are among the most extensively studied atypical ABCs. Standard literature recommends preoperative embolization, complete excision where possible, and instrumented stabilization when instability exists. Neurological recovery following decompression is generally favorable, mirroring our findings [9, 10, 11, 12].

The clavicle and rib are considered relatively expendable bones, making wide resection an attractive option with minimal functional compromise [13,14,15]. There was complete concordance with standard practice. Craniofacial ABCs are rare but recognized. Standard literature notes greater diagnostic difficulty, higher risk of morbidity because of adjacent neurovascular structures and frequent need for multidisciplinary management [15]. Our findings closely match these observations.

Compared with contemporary Orthopaedic oncology literature, atypical ABCs in the present review demonstrated similar demographic characteristics and histopathological features but substantially greater diagnostic complexity owing to their uncommon anatomical locations. While curettage and grafting remain the cornerstone of treatment, many lesions in atypical locations were managed by en bloc excision and reconstruction, resulting in excellent local control and functional outcomes [16,17,18,19]. Interestingly, recurrence rates appeared lower than those reported in large Orthopaedic oncology series, likely reflecting careful patient selection and the frequent use of wide

Table 4: Treatment comparison

Treatment	Our review	Orthopaedic oncology literature
Curettage+grafting	Frequently reported	Established conventional option
Wide resection	Frequently used in atypical sites	Recommended for expendable bones and recurrent lesions
Ethanol sclerotherapy	Reported in a proximal humerus case	Increasingly accepted modality
Polidocanol	Rarely reported in your cases	Healing rates 84–93% reported
Embolization	Not used in reviewed cases	Used selectively; evidence from broader literature
Doxycycline injection	Not reported	Recurrence approximately 5–6% in early series
Denosumab	Not reported	Emerging option for sacral and spinal ABCs
ABCs: Aneurysmal bone cysts		

excision [20,21,22,23,24,25]. Emerging minimally invasive treatments such as selective arterial embolization, polidocanol sclerotherapy, doxycycline injection, and denosumab, increasingly advocated in contemporary literature, were infrequently utilized in the reviewed reports, highlighting an evolving area of ABC management (Table 4) [26,27,28,29,30,31].

Recurrence remains the most clinically relevant challenge in the management of ABC. The literature consistently identifies young age, open growth plates, aggressive radiological characteristics, secondary nature and incomplete excision as major predictors of recurrence [32,33,34]. Most recurrences occur within the first 2 postoperative years, emphasizing the importance of vigilant follow-up during this period. Encouragingly, recurrence rates appear substantially lower following wide resection and modern adjuvant therapies, although long-term comparative data remain limited [15].

The current evidence suggests that successful management of ABC requires a multidisciplinary approach integrating clinical assessment, advanced imaging, histopathological confirmation, and patient-specific treatment planning. Future multicentre studies with longer follow-up periods are required to better define the optimal role of emerging minimally invasive therapies and to establish evidence-based treatment algorithms for lesions arising in uncommon anatomical locations.

Limitations

The findings of this review are subject to important limitations. First, this was a narrative review rather than a systematic review, so author selection bias and publication bias cannot be excluded. Second, the search was restricted to JOCR from 2011 to 2026 and did not include major bibliographic databases; therefore, the evidence base is not representative of the broader international ABC literature. Third, the final evidence base comprised 17 reports (16 case reports and 1 case series) describing 33 patients, making comparisons between anatomical sites and treatment modalities exploratory rather than definitive. Fourth, the included lesions were clinically heterogeneous, including primary and secondary ABCs, different skeletal sites, age groups, fracture status, lesion aggressiveness, and treatment strategies. Primary and secondary ABCs were not sufficiently stratified to permit separate outcome estimates. Fifth, no validated formal risk-of-bias tool was applied; the methodological quality of case reports and the case series therefore remain uncertain. Sixth, functional outcomes were inconsistently reported and were often described qualitatively rather than with validated scores. Follow-up ranged from approximately 10 months to 5 years, which may miss late recurrence, deformity, or functional

impairment. Finally, treatment comparisons are confounded by indication: curettage, wide excision, sclerotherapy, embolization, and reconstruction were selected according to lesion location and clinical circumstances. Accordingly, recurrence rates and treatment effectiveness should not be interpreted as pooled or comparative estimates.

Conclusion

ABCs represent uncommon but clinically significant benign bone lesions characterized by variable presentation and biological behavior. Atypical anatomical locations may pose substantial diagnostic and therapeutic challenges. Advances in imaging, molecular pathology, and minimally invasive treatment have expanded management options beyond traditional curettage. In the present narrative review, histopathological confirmation and individualized treatment planning were recurring themes across published case reports. However, because the evidence was restricted to a single journal and was predominantly composed of case reports, the available data do not permit reliable estimates of recurrence or comparative effectiveness of treatment modalities. Larger multicentre studies using standardized diagnostic, functional, and follow-up measures are required to establish evidence-based treatment algorithms.

Clinical Message

1. Aneurysmal bone cysts are benign but locally aggressive lesions that predominantly affect children and adolescents, with a predilection for the metaphyseal regions of long bones
2. Clinical and radiological presentations can vary considerably, particularly when ABCs occur in uncommon locations such as the pelvis, clavicle, foot, spine, or small bones, often mimicking more aggressive neoplastic conditions
3. MRI demonstrating fluid–fluid levels is highly suggestive of ABC, but histopathological confirmation remains essential to differentiate it from lesions such as telangiectatic osteosarcoma and giant cell tumor
4. Management should be individualized based on lesion size, anatomical location, skeletal maturity, and biological aggressiveness, with options ranging from sclerotherapy and curettage to en bloc resection and reconstruction
5. Modern minimally invasive treatments, particularly percutaneous sclerotherapy, have emerged as effective alternatives to surgery in selected patients, offering high healing rates with reduced morbidity
6. Recurrence remains the most important complication, especially in young patients and aggressive lesions; therefore, careful long-term follow-up is essential
7. Early diagnosis and multidisciplinary management can achieve excellent functional outcomes while minimizing recurrence and preserving skeletal integrity.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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