

Complexities in Diagnosis of Cysts of the Jaws and its Management

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ABSTRACT

Background: Cysts of the jaws are often lined by a layer of epithelium and a layer of subjacent connective tissue and these layers can be dissected easily from bone. The thickness and configuration of this lining varies with the type of the cyst. These cysts develop either by the proliferation of epithelial remnants in the jaw or by cystic transformation of neoplastic tissue. This article includes a comprehensive and up-to-date review on the cysts of the oral cavity. Finally, issues related to differential diagnosis and therapeutic approaches to manage the cysts included are described.

Keywords: Cysts of the jaws, surgical treatment options for cysts, differential diagnosis of cysts.

INTRODUCTION

The word cyst is derived from Greek word KYSTIS meaning a bladder. The cyst may be unilocular or multilocular sac like lesion enclosed by a capsule. Cyst may occur any where in the body but head and neck region is the more common site, this is because of the complex embryology and development of teeth with the presence of varying amount of residual islands which are potentially capable of being involved in the development of cyst.¹ Cyst may assume large proportions causing much local bone destruction with expansion and disfigurement. This may result in thinning of the bone with tendency to fracture. Cyst may arise due to trauma, infection retention or degeneration. Cyst may get secondarily infected that further leads to abscess formation, which may complicate into cellulites, osteomyelitis and sinus formation. Cyst may interfere with normal tooth eruption. Ameloblastoma SCC and muco-epidermoid carcinoma may arise from cyst lining.³

A cyst is a pathologic cavity filled with a fluid or semi-fluid material and lined with epithelium. They are the second most common pathologic radiolucency, and the most common cyst is the radicular cyst, at or near the apex of the tooth.²

History

Ruffer (1921) in his study on paleopathology of Egypt has described lesions in the jaws of 3 mummified specimens which appear to be a radicular cyst. Naga El. Deir (4500 B C) showed a root remnant in the right second premolar of the maxilla. In the second specimen which is thought to be from the same period, the mandibular teeth showed marked attrition and there is cystic area in the bone involving first premolar. Salama and Hilmy (1951) reported on two specimens from a collection of skulls at Sakara. All belong to the period of king Unas of fifth dynasty (2800 B C). One skull showing

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a large radicular cyst in relation to maxillary left anterior region. Another specimen showed a large multilocular cyst in the left body of an edentulous mandible. John hunter writing in about 1780 of disease of the jaw bones, described a type of lesion which appears to be a cyst. Early work on the nature of treatment of jaw cysts appears in the English literature in papers by Spence (1953-54), Harvey (1855), Moon (1877-78), Heath (1880-1887), Pedley (1886), Baker (1891) and Trauner (1898).

DEFINITIONS OF CYST:

- 1) BY KILLEY AND KAY (1966): " A cyst constitutes an epithelium lined sac filled with fluid or semifluid material"
- 2) BY KRAMER(1974): "A cyst is a pathological cavity having fluid, semifluid, or gaseous contents that are not created by the accumulation of pus, frequently but not always, is lined by epithelium."
- 3) BY DR. YASHWANT RAWAL: "A cysts are defined as pathological cavities that may or may not be lined by epithelium and which contain a semisolid or fluid material."

TRUE CYST: "Cysts that are lined by epithelium are termed as true cysts."

PSEUDO CYST: "Cysts that do not possess an epithelium lining are called pseudo cysts or FALSE CYSTS."

INITIATION OF CYST FORMATION:-

In general there are two phases of a cyst:

- a) Initiation or cyst formation,
- b) Enlargement or expansion of cystic cavity.

Many theories have been formulated regarding the mechanism of cyst formation. Some of the important factors responsible for cyst formation are

- 1) Proliferation of the epithelial lining.
- 2) Intra-cystic fluid accumulation.
- 3) Resorption of bone as the fluid accumulates and epithelial lining proliferates.

THE DIAGNOSIS OF CYSTS OF THE JAWS

A stepwise approach is required:-

- (a) Physical examination, i.e. inspect (expansile and asymmetry palpation (bony texture thick vs thin, thrill: auscultation for vascular lesion
- (b) Clinical examination, location, tooth related, tooth vitality, caries, H/O. of surgery
- (c) Radiographic examination; X-ray must show margins of the lesion May consider CT scan or MRI studies
- (d) Aspiration
- e) Biopsy; the surgical procedure for the biopsy must not compromise a subsequent surgical approach for a definitive surgical procedure.

A. History incidental finding vs previous history (trauma, surgery, family Symptoms; pain, swelling, enlargement, caries/infection

B. Clinical examination inspection: majority of cysts are a symptomatic these are discovered during routine radiological examination, cyst can be suspected if swelling is found to be smooth, rounded and painless enlargement of jaw bone, asymmetry / enlargement, caries palpation crepitus / fluctuation bone density, thick vs. thin auscultation; thrill tooth vitality, displacement, crowding. Tooth in relation is import, if missing tooth in young it suggests lesion could be dentigerous cyst. If non vital tooth it may be radicular cyst.

Cysts cause tissue destruction by the displacement of normal functional structures, the weakening of bone or the effects of secondary infection. Displacement, resorption or delayed eruption of teeth may be an initial clinical finding. In rare cases pathologic fractures may be a presenting clinical sign, with odontogenic Cysts only rarely producing alterations in the function of peripheral sensory nerves. Secondary infections may result in cellulitis and / or osteomyelitis.

C. Radiographic Examination: May appear as radiolucent or a mixed radiolucent-radioopaque lesion Uniloculated or multiloculated. May associated with impacted tooth, or tooth may be displaced to inferior border of mandible, coronoid

process or angle region. Margins must be appreciated, or another study may be necessary, at least two views, preferably at right angles (PA, Panorex/ Occlusal). May need to change technique (SLOB Rule) to rule out tooth/root related. CT scan is preferable to MRI in evaluating bony lesions. Sometimes radio opaque contrast may be injected into the cyst, after removing some of the fluid content; this may enhance the margins radiographically. (ex. to rule out sinus involvement)



Fig 1: Occlusal radiograph showing radiolucency on left side of jaw.

D. Aspiration use large lumen needle (14-18g) with 5-10cc syringe Used

(1) To rule out vascular lesions: depending on the resistance to penetrate the needle the nature of lesion could be suspected if no resistance and aspiration negative the cavity may be filled with gas. If aspirate is blood lesion can be vascular. Resistance to penetration and aspiration negative lesion can be solid mass.

(2) To collect specimen for culture / sensitivity, cytology studies. Dentigerous and radicular cyst yields clear straw color fluid containing cholesterol crystals. When this syringe is held under beam of light the crystals are bright and glistening. If little thick similar fluid aspirated from lingual fossa region it can be traumatic bone cyst. Odontogenic keratocyst yields creamy white suspension of keratin.

(3) Insite into possible diagnosis; ex: Straw colored; cystic blood (bright red) vascular: Air; traumatic bone cyst; Vacuum; tumor.

Table 1: Lesions and its composition

Lesions	Albumin	Beta-globulin	Gama-globulin	Protein gm/100ml
Dental cyst	51.19	17.52	22.02	6.30
Dentigerous cyst	61.35	13.98	12.70	5.40
OKC	78.03	7.51	7.91	2.09
Ameloblastoma	67.38	12.83	12.60	4.86



Fig 2: Straw colored fluid aspirant.

E. Biopsy: Inspite of clinical and radiological examination histo-pathological examination is done to confirm the diagnosis. If the small lesion excisional biopsy. If large cyst associated with vital structure incisional biopsy is done to confirm the diagnosis. It is better to keep the operating patient so that cavity is kept in a decompressed state. Depending on the biopsy report further treatment can be planed. Biopsy of a cyst always reveals an epithelium lining that faces towards lumen and connective tissue capsule that forms outer layer of the cyst. In pseudo cyst cystic content is in direct contact with connective tissue. Cyst can also demonstrate inflammatory cells. Exudate, and cholesterol crystals. Differential diagnosis, may consider frozen section at the time of surgery.

Potential Complications

Apart from the obvious problem of cystic enlargement causing weakness of jaw, certain particular potential complication, need to be mentioned, considering their clinical relevance.

I. Infection:

Infection is the most complication of a cyst in the jaw. Normally, if the cyst is totally confined inside a bony cavity or within the soft tissues, there is no chance of it getting infected. Microbes gain access to the cyst through odontogenic passages (i.e. carious cavities, periodontal pockets etc.) or through minor external injuries. Cysts of inflammatory origin, like periapical cyst, are always infected. Infection causes the sclerotic border of the lesion to get blurred in radiograph.

Normally asymptomatic lesions are rendered painful by infection, which prompts the patient to seek treatment. Treatment includes antibiotic therapy and drainage, if necessary, followed by extraction or root filling of associated teeth, and complete curettage of cyst cavity. On opening into the cavity, an intact lining is not usually obtained.

II. Effects on associated teeth

Cysts usually do not cause resorption of the roots of associated teeth, and the vitality of these teeth is not affected in most of the cases. Surgical enucleation of large lesions is associated with teeth can cause disruption of blood supply leading to pulp death and non-response to vitality tests.

Odontogenic cysts are frequently found to cause displacement of the roots of associated teeth. Globulo-maxillary cyst that causes divergence of maxillary lateral incisor and canine roots, is a typical example. Others like OKC also may cause displacement of multiple teeth even though externally discernible swelling may be minimal.

III. Pathologic fracture

This is a direct sequel of the jaw rendered weak by the expanding cyst. This may be caused by the duct enlargement and perforation of a cyst or from minor trauma, to the weakened bone. Surprisingly, some fractures may be asymptomatic since the cyst tissue acts as a splint between the fractured segments.

A pathologic fracture is also a possibility in case a large defect is not adequately managed by filling or grafting, after surgical enucleation.

IV. Recurrence after treatment

Recurrence of the lesion after treatment by enucleation is a relatively common occurrence. The odontogenic keratocysts are especially notorious for this. This complication has much to do with the perfection of surgical procedure. If the cyst lining is not completely removed during treatment, the remnants of the lining may proliferate to cause recurrence.

V. Malignant transformation

Most workers advise removal of the cyst lining as early as possible after the lesion is diagnosed,

because of the capability to undergo pathologic change in course of time. The occurrences of ameloblastoma, squamous cell carcinoma and muco-epidermoid carcinoma have been well documented.

SURGICAL TREATMENT OPTIONS

Treatment Options should use the standard of care, therefore must be current. Depend on the age, medical status, anatomical site, histological and pathological behavior of lesion and overall prognosis. Patient must be informed, and aware of possible need for further Treatment / surgery.

PRINCIPLES OF MANAGEMENT

- 1) Decompression of Intra-cystic pressure.
- 2) Elimination of cystic lining.
- 3) Prevention of teeth with appropriate treatment.
- 4) Prevention of neighbouring anatomical structure.
- 5) Prevention of recurrence of cyst.
- 6) To monitor involved teeth during the postoperative phase, until regeneration of bone is complete.

The different operative procedures are:

1. Enucleation: (Parstch 1910) the total removal of the cystic lining without removal of associated structures (bone). Main advantage is a single surgical procedure and offers a reliable microscopic diagnosis. Used when such a procedure would not result in (a) significant deformity (b) trauma to vital structures -, nerve/sinus (c) fracture to the jaw (d) loss to tooth. Uses a Molt curette with its concave surface facing outwards cyst lining.

2. Decompression: Indicated when cyst is very large or in close proximity to vital structures and where there is significant risk of injury with enucleation. Access site is selected that allows normal function while a flowing ease of drainage and irrigation. Here a small opening is made, the cystic cavity irrigated, suctioned and a tube placed for drainage. Daily irrigation and antibiotics follow. Decompression allows a reduction in intra-cystic pressure, thereby allowing bone regeneration, and a decrease in cystic size. Eventually enucleation is performed to complete surgical care. Main disadvantage; length of treatment, need for daily

care, hygiene considerations and does not allow proper histological study, as such is seldom used.

3. Marsupialization (exterorization, deroofing):

Indications:

- 1) If the cyst is large, possibility of leaving behind a part of the lining from inaccessible area.
- 2) In young patients dentigerous cyst may involve unerupted teeth, Marsupialization may permit eruption of teeth.
- 3) Cyst in close relation with anatomical structure like maxillary sinus, inferior alveolar nerve, nasal cavity this structure will not interfere with anatomical structure.
- 4) In elderly patients who are medically compromised and the patient may not be fit to undergo major surgical procedure like enucleation. Marsupialization can be done under local anesthesia.

Marsupialization differs from decompression in that, the entire roof of the cyst is removed and the cystic lining made continuous with the tissue of the surrounding structures. A decrease in size results, this would allow for Definitive Enucleation or the adjacent tissues would become confluent with what, would have been the cystic lining. Here an acrylic button is used to cover opening to allow for better hygiene.

Disadvantages: Procedure is still time consuming it requires periodic irrigation. Pathological cyst lining is not eliminated totally.

4. Waldron's procedure: Combination of marsupialization and enucleation procedure. If the operator has a doubt about the possibility of leaving behind part of cyst lining either because of inadequacy of surgical capacity of the operator or because of nature of cyst. Waldron's procedure is done. This is done in two phases: phase I marsupialization, this is same as marsupialization and the cavity is allowed to become smaller. Once cavity become smaller phase II procedure ie. Enucleation and primary closure is done.

5. Peripheral Resection (Segmental Resection):

Removal of lesion with a bony margin of 5mm. Here bony continuity is maintained and periosteum MAY be involved.

6. Enucleation with bone grafting: Periosteum and endosteum has a remarkable capacity for generation of bone. Even if the surgeon is confident of enucleating the cyst it may not be successful in too large cyst. Too large hemartoma is liable to breakdown during healing process. To overcome this defect attempt is made to fill the cavity with cancellous bone chips before primary closure. This increase osteogenic potential of the cavity. Other materials like gelform, stored bone have also been used.

7. Enucleation with Peripheral Ostectomy:

Better in areas with direct vision Used in lesions with high recurrence potential (OKC) The ostectomy Involves removing about 2mm of the bony walls This may be achieved with (a) curettes (b) rotary instruments (Acrylic bur) (c) caustic solutions (phenol, Carnoy's solution; a mixture of absolute alcohol, chloroform, glacial acetic acid and ferric chloride (d) hyperthermia and (e) cryosurgery Sometimes methylene blue dye is used to stain the bone to a 2-3mm depth.

8. Enucleation with open packing: Used for large cysts and when there is a likely hood of dehiscence of the soft tissue margins. Iodoform gauze impregnated with antibiotics may be used as packing. Progressively smaller packings are placed. Disadvantage in the longer post-operative care entailing multiple visits.

9. En Bloc Resection: Removal of lesion together with bony margins of 1 cm (10mm) Here bony continuity is disrupted and periosteum is involved.

10. Osseous Sculpture: (used more in tumors) Bony surface is reshaped to remove bulk, without regards to margins.

11. Curettage debrides and stimulates bleeding: Treatment for the Pseudocysts.

All samples should be submitted for histologic examination and definitive diagnosis. Devitalized teeth should be treated with root canal therapy or extractions.

DIFFERENTIAL DIAGNOSIS OF CYSTS OF JAWS

According to Killey and Kay, many bone destroying lesions, certain structural anomalies and anatomical landmarks may produce diagnostic confusion

because of their radiolucent similarity to a cyst space. A thorough knowledge, clinical examination and factual account of the condition will help in diagnosis. It is also important when more than one jaw cyst is detected, to exclude familial history and a genetic defect. Several simple pointers to a firm, provisional diagnosis also helpful in identifying the actual cyst type.

TEETH

Presence of a discolored dead tooth related to a peri-apical dark shadow, sometimes circumscribed by a white cortical line, supports diagnosis of radicular cyst. The absence of tooth in an arch radiographically whose buried crown associated with enlarged follicular space indicative of dentigerous cyst. Occasionally, however associated tooth may be displaced from site of cystic origin, and lead to misinterpretation as suspected neoplasia.

In contrast, whenever a radiolucent cavity is situated beyond the tooth bearing area, and the legitimate possibility is excluded, then the extra-alveolar position must influence the diagnosis in favor of non-cystic pathological process such as neoplasm, a metabolic disturbance, or a fibro-osseous lesion. Similarly, a palatal swelling which lies behind vital central incisors, with a large radiolucent shadow at site of nasopalatine fossa favors the diagnosis of nasopalatine cyst.

BONY EXPANSION

Invasive central tumours -primarily as soft tissue swelling of the palate. A malignant neoplasm -in addition to a swelling will produce gross destruction of the alveolar bone, evident on radiographs. In contrast, a maxillary cyst usually expands into antral cavity laterally and towards the nasal fossa, only at a late stage does it cause a palpable and visible bulge in the palate and probably associated with a lateral incisor and superimposed infection. There is a tendency for cystic lesions anterior to the lower third molar to bulge outwards affecting outline of the buccal cortical plate rather than the lingual side of the mandible. In contrast, behaviour of a neoplasm eg: Ameloblastoma is prone to cause more obvious enlargement on both the aspects of the jaws. A

tumor involves a greater mesio-distal length of jaw than do cyst.

Also mucous membrane covering the neoplasm remains normal in color, unless cortical plate is breached and that covering a sub-mucosal neoplasm is stretched and eventually the superficial blood vessels may appear more prominent than usual.



Fig 3: Painless swelling, showing expansion on buccal side, with overlying normal mucosa

ASPIRATION

A cystic lesion will be filled with straw-colored fluid containing cholesterol crystals and that keratocyst will have a keratin content. Solid tumors seldom yield any aspirated material, but some may undergo central liquefaction and the resultant fluid centrifuged and examined for neoplastic cells. If unable to withdraw anything possibly entered a space filled with soft tissue. Presence of easily aspirated blood - highly suspicious of central haemangioma or aneurismal bone cyst. Also possible to aspirate blood from a cyst into which a brisk hemorrhage has occurred as a result of needle puncture, or from a solid but vascular neoplasm such as an ossifying fibroma. The aspiration of air from a radiolucent area in the maxilla between canine and third molar implies antral cavity has entered confirmed by injecting 10-15 ml of sterile normal saline which will run out of ostium into the nose. If cyst fluid subject to electrophoresis

total soluble proteins less than 5g/100ml -in apical, dentigerous cyst, or non-keratinizing cyst whereas in keratocyst the level usually being less than 4 gm/100ml.

RADIOLOGICAL FEATURES

Classically it shows, rounded radiolucency with a sharply defined border marked out by a white line. As it grows, circular shape modified, for instance, it may extend along the length of bone assuming a sausage like contour. It is differentiated from other pathological processes as following:

1. The presence of trabeculation and /or septa in an area of cavitation suggest the lesion is likely to be a neoplasm, granulomatous or fibro-osseous disorder.
2. According to knight and Manley(1955) with rare exceptions ,simple odontogenic cysts are not lobulated. Partitions actually are ridges on the tiny walls caused by differential bone resorption.
3. A lobulated appearance with mosque -like indentations of the interdental bone between the roots of the standing teeth can be the insignia of the solitary bone cyst and is diagnostic help when lesion discovered by chance radiograph. The lamina dura often intact and vital responses are elicited. With this condition expansion of the normal contour of the jaw is uncommon.

SPECIAL INVESTIGATIONS:

The biochemical laboratory may furnish corroborative evidence of the suspected nature of a lesion for eg: Bence jones proteins of multiple myeloma. The final court of appeal may have to be biopsy.

DIAGNOSTIC INTERPRETATION:

Awareness of normal and abnormal is the best insurance against misdiagnosis.

Anatomical landmarks:

Periapical radiographs of the upper laterals may project the incisive fossa over the central incisor, thus simulating a periapical cyst. The assumption can be averted by confirming that the apices are not denuded of lamina dura and the teeth give positive vitality responses. Similarly, a well demarcated area adjoining the lower incisors, which occurs when the labio-lingual bone is very thin so much that their cortices are fused, which can also mimic a cystic lesion.

DISORDERS OF THE MAXILLARY ANTRUM:

The round, ovoid or dome shaped is probably the most common solitary lesion of the maxillary sinus, but in contrast to the odontogenic cyst it lacks a bony perimeter. Since, it undergoes spontaneous dehiscence or prolapses into the nasal cavity, it is unlikely to cause expansion or pressure atrophy of the antral walls. Also, the angle formed between the floor of antrum and the wall of an ovoid mucous cyst is obviously more acute than that produced by an odontogenic cyst 'invaginating' the floor of the sinus. A mucosal cyst does not generally exhibit intraoral signs and symptoms.

The antral polyp of an allergic or infective aetiology produces a grey shadow projecting from any walls of the antrum. If pedunculated, this mass of chronic oedematous, hypertrophied mucosa is more obvious, but it may have a broad base and more closely resembles a cyst.

The radiographic appearance of any malignant neoplasm in the antrum may be merely that of a soft tissue mass without any special distinguishing characteristic. The earliest radiographic intimation is bone destruction or loss of some portion of the floor or one of the walls of the sinus(Worth 1963). The concurrent signs and symptoms like: a palatal or alveolar swelling accompanied by pain, denture displacement loosening or periodontitis of upper adjacent will differentiate from benign lesion. Other diagnostic features like involvement of eye (diplopia, optic atrophy), nose (epistaxis), facial swelling and paresthesia.

PERIAPICAL CONDITIONS

A small discrete periapical granuloma may resemble an apical periodontal cyst, but frequently the periphery of the lesion is less sharply demarcated than that of a cyst and does not abruptly extend away from the surface of the root. Indeed, sometimes there is fuzziness at the point where the lesion comes off the lamina dura.

GIANT CELL LESIONS:

Clinically, it as a bulging of the inner or outer critical plates, is bluish in appearance like a cyst, but is firm in appearance along with internal striations across the dark area which gives it a fuzzy appearance.

FIBROUS DYSPLASIA:

These may have a cyst like appearance bereft of a complete cortical rim, but if present is well defined and tends to be wider than that of a cyst and there should be a faint trabeculae within the substance of the cavity.

NEOPLASIA AND OSTEOMYELITIS:

In cases of benign tumors which push the teeth, these are lobulated and have a partly crescentic outline. This is in contrast to the simple dental cyst, which will only tilt or move the teeth very late in the adult jaw, after nearly all the supporting alveolar bone has been lost. Clinically, a neoplasm which has penetrated the surface of the bone feels firm on palpation, not fluctuant like the cyst which has outgrown the periosteum. In case of malignant neoplasia or inflammatory bone disease (osteomyelitis), they are often diffuse, poorly demarcated, and perhaps perforating.

Primary malignancies may either cause loss of local bone leaving an irregular, feathery margin. Tooth resorption leaves a spiky root.

AMELOBLASTOMA:

The locules in case of cyst are fewer than those of Ameloblastoma and their peripheral outline sharp, not irregularly sclerosed as in Ameloblastoma. Paradoxically, erosion of tooth roots in Ameloblastoma is an uncommon sign. If present, it takes the form of small irregular erosions (mice like nibbles) at the edge or tip of the root. In cases of cyst the line of resorbed root tip is frequently continuous with the smooth outline of the cyst.

ADENOAMELOBLASTOMA:

Suggestive criteria for diagnostic consideration are,

1. Site proclivity for incisor premolar region.
2. Common association with an unerupted tooth.
3. Early appearance in the second decade.
4. A clearly demarcated periphery.
5. Scattered calcific bodies.

FIBROMYXOMA:

The septa are always straight and incomplete in contrast to the curved continuous wall of a cyst. The

shape of trabeculae spaces is rectangular or triangular.

FIBROMA:

Clinically firm palpation and a heavy lobulated outline radiographically.

MISCELLANEOUS DISEASES:

MYELOMATOSIS:

They are distributed throughout the skeleton particularly the skull, sternum ribs and clavicles. In case of jaws the porosity may be diffuse and root resorption occurs. The clinical picture (recurrent back pain, progressive anaemia, weight loss, mental paresthesia, tooth mobility) with radiographic evidence, and biochemical evidence (BENCE JONES PROTEINS) contributes to the diagnosis.

HISTIOCYTOSIS X

The suspicious signs are marked mobility or spontaneous exfoliation of teeth and failure of sockets to heal.

CONCLUSION

Cystic lesions are very common in jawbones and it includes those of both odontogenic and non-odontogenic origin. Odontogenic cysts are unique to the jawbones, and it often results in considerable destruction of these bones. The diagnosis of these lesions is often delayed because of their innocent presentation. By the time of diagnosis, most of the cyst will be enlarged considerably weakening the bones.^{4,9,11} This leads to various sequelae such as fractures. Other complications even though rare such as malignant transformation of cystic lining is of considerable importance of various surgical modalities available, enucleation with primary closure should be treatment of choice wherever possible because of the least unfavourable sequelae.^{3,6}

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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