Original Article

A clinical study of cysts of the maxillofacial region; and an assessment of clinico-radiologico-pathological variables affecting the formulation of a comprehensive patient need based treatment plan

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Abstract

Objectives: Evaluation of clinical presentation of cystic lesions of the maxillofacial region, their relation to radiological picture, and treatment planning so as to plan and execute a patient need based treatment modality after co-relating it to the eventual histopathological diagnosis. Methods: 25 cases with clinico-radiological diagnosis of a cyst were selected and treated, and the diagnosis was co-related to the eventual histopathological diagnosis. The patients were followed up for at least 3 months (3-12 months). An attempt was made to underline patient and lesion related variables having a bearing on the choice of treatment modality in each case. Results: Out of 25 patients, 28% were females and 72% males. Commonly affected age groups were 11-20 (40%) and 31-40 years (24%). 76% of 25 patients complained of swelling on the first visit. 96% lesions were related to jaws, of which 15 were in the mandible and 9 were in the maxilla. 58.33% bone lesions had cortical expansion. 92% lesions were confirmed to be cysts histopathologically. Two were ameloblastomas. 80% patients underwent enucleation with various adjunctive procedures. 32% patients faced temporary post operative complications. No recurrences were observed. Radiological presentation of lesions and patient’s age were found to be the two most important radiological and clinical variables affecting treatment planning. Conclusions: A comprehensive patient need based treatment plan can be reached only after taking various patient and lesion related variables (which may manifest as clinical, radiological or histological parameters) into consideration.

Key words: Cyst, enucleation, odontogenic, treatment, variable

INTRODUCTION

Cysts of jaws are not new lesions. Lesions of the jaws interpreted as cysts have been found in mummified specimens from the Egyptian era in 4500 B.C.¹ As early as 1903, Oliver² extrapolated Sutton’s classification of odontomes, wherein cysts were described as variants of odontomes. From around the turn of the 20th century, scientific papers on the nature and treatment of jaw cysts became more frequent. Partsch (1892) described an operation for exteriorization of cysts of jaws by removing overlying mucosa, periosteum, bone and adjacent cyst wall.³

In 1910, he recommended complete enucleation of lining of cysts of jaws up to the size of cherry and primary closure of the wound.³ Barrie (1905) was probably one of the first authors to describe resection for an aggressive multilocular cyst.⁴

The long and rich historical knowledge regarding recognition and treatment of cystic lesions led Prof Bramley (1971) to exclaim, “Is there any new thing to say on treatment of cysts of jaws?”³

Enucleation and marsupialization still form the blueprint of treatment planning involving cystic lesions of jaws. However, the ongoing changes in our understanding of cysts, especially in the background of advent of newer cystic entities and reclassification of old ones,
and advances in imaging, histopathological evaluation, diagnosis and treatment of cystic lesions, make periodic updates necessary. The blueprint therefore needs to be embellished by various adjunctive procedures as per the individual patient’s needs to result in a comprehensive treatment plan. The individualization of treatment plan based on various clinical, radiological and histological variables is especially pertinent in developing countries, where the clinical course of jaw cysts is relatively longer due to poor awareness, difficult access to health care, and often late diagnosis; and the treatment choices are conversely more difficult to make. Therefore a clinical study of cysts and an inventory of the various factors affecting choice of treatment are quite relevant in the given scenario.

**METHODS**

Twenty five cases were selected for this study out of the patients reporting to the department of Oral and Maxillofacial Surgery in 2006-2008. The included cases had clinical and/or radiological findings suggestive of a cyst, which were catalogued with the help of a case history proforma for cystic lesions.

Ten clinical and seven radiological variables [Tables 1 and 2] potentially guiding the choice of treatment modality for each patient were analyzed by all four members of the operating team. Variables that had a bearing on the choice of modality (if any) were individually highlighted by each member of the operating team, and considered positive if the majority agreed on the same. Whether the variable dictated a more conservative or aggressive modality was also noted.

Based on the clinico-radiological picture, treatment was performed by the time tested methods of enucleation [Figure 1], marsupialization [Figure 2], and/or with various adjunctive procedures such as chemical cautery (using Carnoy’s solution), peripheral ostectomy, plate reconstruction, Caldwell Luc procedure etc., or the more mundane extractions, RCT-apicocoeectomy, or open packing with Iodoform gauze, as per need; Curettage and segmental resection were also performed in certain cases. Specimens obtained surgically were sent for histopathological examination post operatively. The patients were then followed up based on clinical and/or radiological criteria [Table 3] for one year.

**OBSERVATIONS AND RESULTS**

Table 1 represents case summaries of the 25 patients included in this study in accordance with the studied parameters. Graph 1 illustrates the distribution of patients based on age and sex. Chief complaints ranged from swelling (most common) to accidental detection on cephalometric radiographs taken prior to orthodontic treatment in 1 patient. Aspiration could be performed for 92% patients, and appearances varied from straw coloured (68%), to white cheesy (16%) to red serosanguineous (8%). 37.5% of the intraosseous lesions were associated with non vital teeth. 90% of the 25 lesions were related to the jaws, of which 15 (60% of all cysts and 62.5% of jaw cysts) were in the mandible and 9 (36% of all cysts and 37.5% of jaw cysts) were in the maxilla.

Graph 2 shows the distribution of lesions according to location. 62.5% lesions were unilocular with smooth sclerotic border, 25% were unilocular with scalloped margins, 8.3% were multicellular, 4.1% had honeycomb appearance, and 12.5% were radio-opaque lesions associated with the maxillary antrum. Besides the antrum, other associated anatomic structures included nasal cavity and nasopalatine canal (8.3%), inferior alveolar nerve (20.8%), mental foramen (4.1%), and unerupted teeth (23%).

Roots of related teeth were resorbed in 16.67% cases, all in the mandible.

Enucleation was carried out in 80%, marsupialization in 4%, curettage in 8%, excision in 4%, and segmental resection in 4% patients. Enucleation was combined with various adjunctive procedures as represented in Table 1, including chemical cautery with Carnoy’s solution (35%) and peripheral ostectomy with rotary round carbide burs (10%).

Of the 25 lesions believed to be cysts on clinical and/or radiological examination, 23 (92%) turned out to be cysts histologically, according to Shear and Speight’s classification (2007). The 23 cysts were classified according to Shear and Speight’s classification (2007) into various histopathological types [Graphs 3 and 4]. The remaining two lesions were neoplasms (ameloblastomas).

On evaluation of clinical, radiological and intra-operative observations, variables with the highest relevance to treatment planning were, surprisingly, radiological ones. All radiological pictures other than unilocular (36%) were recognized as candidates for more aggressive procedures.

Clinically, aspirates other than straw colored fluids (24%), complaints other than swelling (20%), bone changes beyond cortical expansion (16%), incidence of root resorption (16%) and thin friable linings also lent themselves to more aggressive
Table 1: Evaluation of clinical variables (pre- and intra- operatively). Positives (+) are highlighted and the total no. of positives mentioned at the bottom of each column

| S. no | Age/sex | Chief complaint(s) | Site   | H/O previous procedure | Bone changes          | Non vital teeth | Aspiration | Cystic lining | Biopsy taken |
|-------|---------|--------------------|--------|------------------------|-----------------------|-----------------|------------|--------------|--------------|
| 1     | 42/M    | Swelling-palate    | Maxilla| Expansion-palatal       | 21                    | Straw           | Excisional |
| 2     | 19/F    | Swelling-cheek     | Maxilla| Expansion-buccal        | 16                    | Straw           | Excisional |
| 3     | 35/F    | Swelling-jaw       | Mandible| Marsupialization        | 11,21,22              | Straw           | FRIABLE    |
| 4     | 31/M    | Swelling-cheek     | Maxilla| Expansion-buccal        | 11                    | Straw           | Excisional |
| 5     | 18/F    | Swelling-jaw       | Mandible| Yes                     | Curettage             | Red             | Absent     | Piecemeal   |
| 6     | 36/F    | Swelling-palate    | Maxilla| Expansion-palatal       | 17 roots              | Straw           | Adherent   | Excisional |
| 7     | 30/M    | Swelling-palate    | Maxilla| Yes                     | RCT                   | Straw           | Excisional |
| 8     | 18/M    | Swelling-palate    | Maxilla| Yes                     | Excisional            | Straw           | Excisional |
| 9     | 17/F    | Swelling-jaw,     | Mandible| Perforation-buccal      | 18                    | Straw           | Excisional |
| 10    | 12/M    | Swelling-jaw       | Mandible| Marsupialization        | 31,41                 | Straw           | Excisional |
| 11    | 30/M    | Swelling-jaw       | Mandible| Contralateral cyst removal | 11,21,22             | Straw           | Excisional |
| 12    | 15/M    | Swelling-jaw, missing teeth, Discharge | Mandible| Expansion-buccal        | 31                    | Straw           | Excisional |
| 13    | 35/M    | Swelling-jaw, Paraesthesia | Mandible| Perforation-buccal      | 18                    | Straw           | Excisional |
| 14    | 18/ M   | Discharge          | Mandible| White                   | 75                    | Straw           | Excisional |
| 15    | 55/M    | Swelling-preauricular, Discharge | Mandible| Enucleation             | 11                    | Straw           | Excisional |
| 16    | 35/M    | Swelling-jaw, Paraesthesia | Maxilla| Apicocoeotomy            | 18                    | Straw           | Excisional |
| 17    | 13/F    | Cephalometric finding | Mandible| Yes                     | 18                    | Straw           | Excisional |
| 18    | 7/M     | Mobile tooth       | Mandible| Expansion-buccal        | 18                    | Straw           | Excisional |
| 19    | 70/M    | Swelling-jaw       | Maxilla| Expansion-buccal        | 11                    | Straw           | Excisional |
| 20    | 17/F    | Swelling-jaw       | Maxilla| Expansion-buccal        | 17                    | Straw           | Excisional |
| 21    | 13/M    | Missing tooth      | Mandible| White                   | 17                    | Straw           | Excisional |
| 22    | 50/M    | Swelling-palate    | Maxilla| Expansion-buccal        | 16                    | Straw           | Excisional |
| 23    | 21/M    | Swelling-lip       | Lower lip| Yes                     | 16                    | Straw           | Excisional |
| 24    | 32/M    | Missing teeth      | Mandible| Expansion-buccal        | 16                    | Straw           | Excisional |
| 25    | 50/M    | Swelling-jaw       | Maxilla| Extraction              | 15                    | Straw           | Excisional |
| +     | 8       |                    |        |                        | 9                     | Straw           | Excisional |
|       | 6       |                    |        |                        | 6                     | Straw           | Excisional |

Table 2: Evaluation of radiological variables. Positives (+) are highlighted and the total no. of positives mentioned at the bottom of each column

| S. no | Radiograph(s) taken | Side | Site     | Size    | Picture | Vital structures | Roots resorbed |
|-------|---------------------|------|----------|---------|---------|------------------|---------------|
| 1     | IOPA, occlusal      | Left maxilla | Anterior | Large   | Unilocular | -                | -             |
| 2     | OPG, PNS            | Right maxilla | Molar   | Large   | Unilocular | IAN              | -             |
| 3     | OPG, CT             | Left mandible | Body    | Medium  | Scalloped | IAN              | -             |
| 4     | Occlusal, PNS, IOPA | Bilateral maxilla | Anterior | Large   | Unilocular | -                | -             |
| 5     | OPG, CT             | Bilateral mandible | Anterior | Medium  | Honeycomb | -                | -             |
| 6     | PNS, CT             | Right maxilla | Molar   | Medium  | Unilocular | Antrum           | -             |
| 7     | OPG, IOPA           | Left maxilla | Anterior | Large   | Unilocular | Nose, NPN        | -             |
| 8     | OPG, IOPA           | Left maxilla | Anterior | Large   | Unilocular | IAN              | 45, 46        |
| 9     | OPG                 | Right mandible | Third molar | Small  | Multilocular | -                | -             |
| 10    | OPG                 | Left mandible | Premolar | Medium  | Unilocular | -                | 36            |
| 11    | OPG                 | Left mandible | Third molar | Medium | Scalloped | -                | 37, 38        |
| 12    | OPG                 | Bilateral     | Canine   | Medium  | Unilocular | -                | -             |
| 13    | OPG                 | Right mandible | Canine   | Large   | Scalloped | -                | 44,45,47      |
| 14    | OPG                 | Right mandible | Third molar | Medium | Scalloped | -                | -             |
| 15    | OPG, left lateral oblique | Left mandible | Condyle | Medium  | Scalloped | TMJ              | -             |
| 16    | OPG, IOPA           | Left maxilla | Anterior | Small   | Unilocular | -                | -             |
| 17    | OPG, IOPA           | Left mandible | Anterior | Small   | Scalloped | -                | -             |
| 18    | OPG                 | Left mandible | Premolar | Medium  | Unilocular | -                | -             |
| 19    | OPG                 | Left mandible | Premolar | Medium  | Unilocular | -                | -             |
| 20    | OPG, IOPA           | Right maxilla | Anterior | Medium  | Unilocular | Antrum, 11       | -             |
| 21    | OPG                 | Left mandible | Canine   | Large   | Unilocular | -                | -             |
| 22    | OPG                 | Bilateral     | Maxilla  | Anterior | Large   | Unilocular       | -             |
| 23    | -                   | -              | -        | -       | -              | -                | -             |
| 24    | OPG                 | Bilateral     | Canine   | Large   | Unilocular | -                | -             |
| 25    | OPG                 | Left maxilla  | Body     | Large   | Multilocular | -                | -             |

IOPA: Intra oral peri apical radiograph, OPG: Orthopantomogram, PNS: Paranasal sinus view of maxilla, CT: Computed Tomogram
patients age was the most common clinical variable affecting the operating teams choice of a treatment plan. Patients in this group were all aged less than 20 or more than 70 years, recommending more conservative procedures to operator’s minds. History of previous surgery resulted in operators choosing more aggressive modalities in 4 cases, and rightly so as two of these turned out to be ameloblastoma on histopathological examination.

Site of the lesion was found relevant to treatment planning in only 16% cases where lesions were associated with the maxillary antrum and

### Table 3: Diagnosis, treatment and follow-up (clinical and radiological)

| Provisional diagnosis | Treatment modality | Adjunctive treatment | Final diagnosis | Follow up (month) | Clinical complication(s) | Radiographic healing (seen as trabeculae) | Reduced radiographic size |
|-----------------------|--------------------|----------------------|----------------|-------------------|--------------------------|------------------------------------------|---------------------------|
| Radicular             | Enucleation        | RCT, Apicocoeectomy  | Radicular      | 12                | Hematoma                | Yes                                      | Yes                       |
| Radicular             | Enucleation        | Caldwell Luc, Apicocoeectomy, Gelsponge | Radicular      | 12                | Hematoma                | Yes                                      | Yes                       |
| Residual              | Enucleation        | Chemical cautery, open packing | Ameloblastoma  | 12                | Paraesthesia             | Yes                                      | Yes                       |
| Radicular             | Enucleation        | Open packing, RCT HA plug graft | Radicular      | 9                 | Yes                      | Yes                                      | Yes                       |
| Radicular             | Enucleation        | Caldwell Luc, extractions, Gelsponge | Radicular      | 12                | Persistent swelling      | Hematoma                                | Yes                       |
| Radicular             | Enucleation        | RCT, Apicocoeectomy, Gelsponge | Radicular      | 3                 | Yes                      | Yes                                      | Yes                       |
| Radicular             | Enucleation        | RCT, Apicocoeectomy, HA plug graft | Radicular      | 12                | Yes                      | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Chemical cautery, peripheral ostectomy | Keratocyst     | 6                 | Yes                      | Yes                                      | Yes                       |
| Dentigerous           | Enucleation        | Chemical cautery, HA plug graft | Ameloblastoma  | 3                 | Dehiscence               | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Chemical cautery | Keratocyst     | 6                 | Dehiscence 31,41         | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Biopsy, then segmental resection | Keratocyst     | 12                | Functional, esthetic     | Paraesthesia                            | Yes                       |
| Keratocyst            | Enucleation        | Chemical cautery | Keratocyst     | 6                 | Yes                      | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Access osteotomy, chemical cautery, peripheral ostectomy | Keratocyst     | 6                 | Yes                      | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | RCT, apicocoeectomy | Radicular      | 6                 | Yes                      | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Extraction 74 | Dentigerous     | 6                 | Eruption 35              | Yes                                      | Yes                       |
| Keratocyst            | Enucleation        | Chemical cautery | Keratocyst     | 6                 | Yes                      | Yes                                      | Yes                       |
| Dentigerous           | Enucleation        | Open packing | Dentigerous     | 3                 | Yes                      | Yes                                      | Yes                       |
| Dentigerous           | Enucleation        | Extraction of impacted 43 | Dentigerous     | 6                 | Yes                      | Yes                                      | Yes                       |
| Nasopalatine          | Enucleation        | Extraction of unerupted | Nasopalatine   | 3                 | Yes                      | Yes                                      | Yes                       |
| Mucocoele             | Excision           | Minor salivary gland removal | Mucocoele      | 3                 | Yes                      | Yes                                      | Yes                       |
| Dentigerous           | Enucleation        | Extraction of unerupted | Dentigerous     | 3                 | Yes                      | Yes                                      | Yes                       |
| Residual              | Enucleation        | Open packing, extraction 36,38 | Residual       | 3                 | Yes                      | Yes                                      | Yes                       |

RCT: Root Canal Treatment, HA: Hydroxy Apatite
**DISCUSSION**

Radiological picture of cystic lesions and patient’s age were found to be the two most important variables affecting treatment planning, while factors such as size and site of the lesion did not have any major impact on treatment planning.

Age as the most important clinical variable attests to the importance duly given by operators to the patients’ quality of life, while keeping options for recurrence management or future treatment open.\(^\text{[7,8]}\) History of previous surgery, on the other hand, seems to warn operators to treat the lesion aggressively, giving precedence to longevity and prognosis of treatment.

Clinico-radiological diagnosis coincided with the histopathological diagnosis in 92% cases, highlighting the simplicity of cyst diagnosis with careful history taking and clinical examination for features such as swelling, buccal cortical expansion, straw colored aspirate, unilocular radiolucent picture, to name a few.

Any deviation from these pathognomonic features of oral or maxillofacial cysts was seen to tilt the operators’ minds towards aggressive and/or adjunctive procedures. Incidentally, radiological pictures other than simple unilocular ones also tended to be clustered with more advanced clinical features. Most of these lesions turned out to be keratocystic lesions, hemorrhagic cysts, or neoplasia, thereby justifying the controversy surrounding their oncogenetic origins and pro-neoplastic nature.\(^\text{[5]}\)

Enucleation has once again been validated as the most suitable modality for almost all cysts, with various adjunctive procedures (as deemed necessary in each case). Relatively complicated procedures were chosen more due to the age, presenting picture, relatively aggressive clinical course or poorly accessible site of lesions, rather than their histopathological diagnosis per se, further underlining the need for and relevance of custom made treatment plans for each patient.

The treatment results were satisfactory in all cases, justifying the choice of treatment modalities, though the study period is, inadequate to observe long term recurrence or neoplastic transformation of these lesions.\(^\text{[9,10]}\) Observance and management of these factors is therefore recommended during the treatment planning for cysts in all cases.

Based on all the previously discussed factors, the following treatment protocol is advised.

1. For inflammatory cysts, which presented as

![Graph 1: Distribution according to age and gender](image1)

![Graph 2: Distribution according to site of the lesion](image2)

![Graph 3: Distribution of the 25 lesions according to histopathological diagnosis](image3)
periapical radiolucencies in relation to discoloured or fractured non vital teeth (commonly in the anterior maxilla of young adult male patients), decayed or extracted teeth (commonly in the posterior arches), enucleation is the treatment of choice. In case of radicular cysts associated with salvageable but consistently non vital teeth, the procedure should be combined with root canal therapy and apicocoectomy. Teeth deemed unsalvageable should be extracted

2. For dentigerous cysts, which are often seen as a unilocular radiolucency related to the crown of an unerupted tooth, the status of the tooth/ teeth in relation to the cyst should be evaluated first. If the tooth can erupt, or can be guided orthodontically into occlusion, marsupialization along with preservation of the tooth should be the treatment of choice. If the tooth is malpositioned and difficult to bring into function, or has altered anatomy which makes it expendable, it should be extracted along with cyst enucleation

3. A consensus on the ideal treatment of odontogenic keratocysts has remained elusive so far. They usually present as unilocular radioluencies with scalloped margins, or multilocular radiolucencies, often associated with unerupted teeth in the mandibular body and third molar region. They tend to grow in a horizontal fashion, expand both the cortical plates, and at times perforate cortices. They are also more often associated with resorption of related tooth roots. On the basis of this study, it is suggested that small unilocular cysts should be managed by enucleation with chemical cautery and/or peripheral ostectomy, especially in lesions with vital structures in close approximation, patients at extremes of age, and medically compromised patients. Large cysts, which are multilocular or unilocular with scalloped margins, and associated with aggressive features like resorption of related teeth, both buccal and lingual cortical expansion, and multiple perforations, should be considered for more aggressive treatment like segmental resection

4. Non odontogenic epithelial cysts such as nasopalatine cysts are amenable to treatment by simple enucleation

5. The treatment favoured for patients with hemorrhagic cysts is curettage. Grafting of the cavity might be performed for dead space management

6. Cysts of minor salivary gland origin such as mucocoeles should be excised along with removal of the underlying minor salivary glands to prevent recurrence.

From the course of this study, by correlating the lesion to histopathological examination, it is emphatically stated that cystic lesions should be enucleated as far as possible if the same can be obtained without damaging the neighbouring structures and bone. Further, a long term follow up for cystic lesions is advised, especially for odontogenic keratocysts and dentigerous cysts.

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