



CARNOY'S SOLUTION AS A SURGICAL MEDICAMENT IN THE TREATMENT OF KERATOCYSTIC ODONTOGENIC TUMOUR

DR. MADHULAXMI. M AND DR. P.U. ABDUL WAHAB*

*Department of Oral and Maxillofacial surgery
Saveetha Dental College Chennai, India.*

ABSTRACT

Carnoy's solution was first used as a medicament in surgery by Cutler and Zollinger in 1933. The reformulated carnoy's solution without chloroform is accepted because exposure to chloroform has been associated with cancer and reproductive toxicity. It is assumed that carnoy's solution eradicates epithelial rests from the cyst wall and reduces the rate of recurrence. In the world health organization (WHO) classification of head and neck tumours from 2005, odontogenic keratocyst was reclassified and renamed to keratocystic odontogenic tumour (KCOT). Rate of recurrence was reduced when carnoy's solution was used as an adjunct therapy after the enucleation of keratocystic odontogenic tumour.

KEYWORDS : Carnoy's solution, Cyst, KOT, Recurrence



DR. P.U. ABDUL WAHAB
Reader, Saveetha Dental College, Chennai, India

INTRODUCTION

A cyst is a pathological fluid filled cavity lined by epithelium[1] or occasionally by neoplastic tissue[2]. They are the most common cause of chronic swellings of the jaws and are more common in jaws due to rests of odontogenic epithelium remaining in the tissues. It may arise in any of the soft or hard tissues of the oral and maxillofacial regions[1]. The term keratocyst was coined by Philipsen in 1956. In the world health organization (WHO) classification of head and neck tumours from 2005, odontogenic keratocyst was reclassified and renamed to keratocystic odontogenic tumour (KOT) [2]. Unlike the other cystic lesion KOT, has got strong tendency for recurrence [3]. Treatment of these lesions remains controversial and has a number of dilemmas [4,5,6] about the choice of treatment whether to use carnoys solution as an adjunct therapy after removal of the lesion. The aim of this paper was to know whether the use of carnoys's solution is effective in the treatment of keratocystic odontogenic tumour and lowers the recurrence rate. Carnoy's solution was first used as a medicament in surgery by Cutler

and Zollinger in 1933 [7] It is a powerful fixative, haemostatic and cauterizing agent which penetrates cancellous spaces in the bone and devitalizes and fixes the left out tumour cells [8]. Success of the application of this medicament after enucleation of KOT is thought to be due to both penetration and fixation action [9]. Carnoy's solution may be used in the bony region but preferably not in close proximity to the neural structures and maxillary sinus region to avoid damage to the neural tissue and necrosis of the sinus wall [10]. The reformulated carnoy's solution without chloroform is accepted because exposure to chloroform has been associated with cancer and reproductive toxicity [11]. It is assumed that carnoy's solution eradicates epithelial rests from the cyst wall. Its average depth of penetration is 1.54mm after 5 mins of application [6]. But the duration of application is not clarified in the existing literature. However Blanas et al [12] state that application of carnoy's solution to cyst cavity for 3 mins after enucleation should not damage the inferior alveolar nerve.

Composition of carnoy's solution

Carnoy's solution II (Recommended by Cutler and Zollinger - 1933) [7]:

Ferric chloride - 1 gram

Chloroform - 3ml

Glacial acetic acid - 1ml

Absolute alcohol - 6ml

Carnoy's solution I (Farmers solution) [13] :

Absolute alcohol - 3ml

Glacial acetic acid - 1ml

Modified Carnoy's solution [13]

Ferric chloride - 1gram

Glacial acetic acid - 1ml

Absolute alcohol - 6ml

Uses of carnoys sountion in oral surgery

1. Used to fix the tissue after enucleation of the KOT
2. Used to fix the tissue after enucleation of few types of ameloblastoma

Mechanism of action of carnoys solution

Carnoy's solution is a fixative agent where absolute alcohol hardens the tissue by

shrinkening it, glacial acetic acid swells tissue and prevents overhardening , chloroform increases the speed of fixation and ferric chloride acts as a dehydrating agent.

Adverse effects

Among all the ingredients of carnoys solution, chloroform is considered to be very hazardous and should be used in a ventilated hood by

wearing masks. Exposure to chloroform has been associated with cancer and reproductive toxicity [11]. Alteration in the neural conductivity after direct application of Carnoy's solution over 2 minutes [14]. Carnoy's solution does not maintain the osseous structure where as cryotherapy maintains bony architecture and facilitates new bone formation [15].

Role of Carnoy's solution in the management of KCOT

Keratocystic odontogenic tumour (KCOT) is a benign, uni or multicystic, intraosseous tumour, which originates from the dental lamina and its remnants, with a characteristic lining of parakeratinised layered squamous epithelium and it has a potential for aggressive, infiltrative behaviour [16]. It is common in the young male patients and occurs more commonly in posterior part of the mandible. The choice of treatment was based on the size of the cyst, recurrence status, and radiographic evidence of cortical perforation. Different surgical treatment options like marsupialization, enucleation, enucleation with Carnoy's solution, peripheral ostectomy with or without Carnoy's solution, jaw resection have been discussed in various studies [2]. Although various therapies for KCOT have been documented in the literature, the universally accepted approach remains undecided. The recurrence rate for each treatment option varies from 5 to 62% [1].

REFERENCES

1. Neelima A. M, the textbook of oral and maxillofacial surgery, 1st edition, chapter 35; 401-415, (2002).
2. Stevo M, Zoran D, Zoran I, Milka G, Dobrila R. Peripheral ostectomy with the use of Carnoy's solution as a rational surgical approach to odontogenic keratocyst: A case report with a 5 year follow-up. *Vojnosanit Pregl* 69(12): 1101-1105, (2012).
3. Cawson R.A, Odell E.W. Essentials of oral pathology and oral medicine. Sixth edition; chapter 7, 97, (2000).
4. Stoelinga PJ, The treatment of odontogenic keratocyst by excision of the overlying, attached mucosa, enucleation,

and treatment of the bony defect with Carnoy's solution. *J Oral Maxillofac Surg*.63,1662-6, (2005).

Many studies do not have an adequate follow-up period making the reported recurrence rate trustworthy. According to Tolostunov et al [17] the recurrence rate after enucleation without Carnoy's solution is 25-50%. Pitak et al [6] in their study have noticed the recurrence rate of 26% without Carnoy's solution, whereas Chirapathomsakul et al [18] have found it to be 13.3%. Lau et al [9] in their study have mentioned the recurrence rate of 18% when Carnoy's solution was used and 30% when Carnoy's solution was not used and have concluded that using Carnoy's solution lowers the recurrence rate.

CONCLUSION

Though using Carnoy's solution has its adverse effect on neural tissue and carcinogenic activities if chloroform is added, it lowers the recurrence rate after enucleation of Keratocystic odontogenic tumour. To outweigh the risks, reformulated Carnoy's solution can be used and avoid using the Carnoy's solution in close vicinity to the nerve. A prospective study which includes multiple treatment options with conventional and modified Carnoy's solution and without Carnoy's solution is recommended to find out the recurrence rate and duration of application of Carnoy's solution to be derived in the future studies.

5. Morgan TA, Burton CC, Qian F. A retrospective review of treatment of the odontogenic keratocyst. *J Oral Maxillofac Surg*; 63(5): 635-9 (2005)
6. Pitak-Arnop P, Chaine A, Oprean N, Dhanuthai K, Bertrand JC, Bertolus C. Management of odontogenic keratocysts of the jaws: a ten-year experience with 120 consecutive lesions. *J Craniomaxillofac Surg*; 38(5): 358-64 (2010)

7. Cutler EC, Zollinger R. Sclerosing solution in the treatment of cysts and fistulae. *Am JSurg*;19:411, (1933).
8. Ralph A. C. A. Voorsmit, Paul J. W. Stoeltinga, Urbain J. G. M. van Hadst, The Management of Keratocysts. *J. max.-fac. Surg.* 9, 228-236, (1981)
9. Lau SL, Samman N. Recurrence related to treatment modalities of unicystic amelo-blastoma: a systematic review. *Int J Oral Maxillofac Surg*;35:681–90, (2006)
10. Stoeltinga PJW. Excision of the overlying, attached mucosa, in conjunction with cystenucleation and treatment of the bony defect with Carnoy solution. *Oral Maxillofac Surg Clin North Am*;15:407–14,(2003)
11. Fabrizi L, Taylor GW, Can˜as B, Boobis AR, Edwards RJ. Adduction of the chloroform metabolite phosgene to lysine residues of human histone H2B. *Chem Res Toxicol*;16:266–75,(2003)
12. Blanas N, Freund B, Schwartz M, Furst IM. Systematic review of the treatment and prognosis of the odontogenic keratocyst. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*; 90(5): 553–8 (2000)
13. Fixatives for plant cytogenetics, wheat genetic and genomic resources centre, Kansas university, April (2007)
14. Sivaraj Sivanmalai, Kohila Kandhasamy, and Chandrakala Shekarappa Annapurna Pannaikadu Somasundaram Prabu Carnoy's solution in the management of odontogenic keratocyst *Journal of Pharmacy & Bioallied Sciences J Pharm Bioallied Sci.* August; 4(Suppl 2): S183–S185, (2012)
15. Schmidt BL, Pogrel MA. The use of liquid nitrogen cryotherapy in the management of odontogenic keratocysts. *J Oral Maxillofac Surg*;59:720–5, (2001)
16. Mendes RA, Carvalho JF, van der Waal I. Characterization and management of the keratocystic odontogenic tumor in relation to its histopathological and biological features. *Oral Oncology.*; 46: 219-225, (2010)
17. Kaczmarzyk T, Mojsa I, Stypulkowska J. A systematic review of the recurrence rate for keratocystic odontogenic tumour in relation to treatment modalities. *Int. J. Oral Maxillofac. Surg*; 41, 756-767, (2012).
18. Chirapathomsakul D, Sastravaha P, Jansi-syanont P. A review of odontogenic keratocyst and behaviour of recurrences. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*; 101: 5-9, (2006)