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

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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

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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 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 solution 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 carnoys 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].

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 carnoys 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 carnoys 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 overweigh 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.

REFERENCES