Clinical use of hydrogen peroxide in surgery and dentistry – why is there a safety issue?

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VERIFIABLE CPD PAPER

IN BRIEF

- Hydrogen peroxide is a safe product to use as long as it is used in a controlled manner.
- Hydrogen peroxide has caused much confusion and controversy in dentistry but is used in much more invasive and precarious situations in medical surgery.
- The dental profession should consider hydrogen peroxide more often in clinical use.

PRACTICE

The use of hydrogen peroxide (HP) is limited in dental surgery by UK interpretation of EC legislation. The product, however, has wide application in surgery, particularly in the debridement of wounds. Its use in sensitive areas such as the carotid artery and vein illustrate its value in safely cleaning wounds.

INTRODUCTION

Hydrogen peroxide (HP) is a colourless liquid with a bitter taste which dissolves in water to give an acidic solution.¹ It is a strong oxidising agent that produces free radicals, HP anions and reactive oxygen molecules.² It has found many historic applications in both medicine and dentistry but its role in dentistry in bleaching teeth has generated controversy. This controversy is based on the legal and legislative principles rather than risk of complications in clinical practice. The current legal position in the UK renders the sale and supply of solutions containing >0.1% hydrogen peroxide illegal.³ The object of the present article is to show the application of HP solution in the management of wounds in the head and neck. Its use is vital in some situations.

CLINICAL CASE 1

A male patient aged 59 with a squamous cell carcinoma (SCC) of the left lateral border of the tongue presented to the head and neck clinic at Guy's Hospital in April 2004. The tumour was treated with surgery and the defect repaired with a radial forearm free flap. Unfortunately the patient developed a second primary tumour, this time in the right buccal mucosa. Once

Fig. 1 Flap failure led to a necrotic infected neck

Fig. 2 In between washings the wound was packed with gauze lined with 1% HP cream

again the tumour was treated surgically and the defect closed with a right antero-lateral thigh flap followed by adjunctive radiotherapy. Treatment was completed

in 2007 and the patient remains disease free. However, four months after completion of radiotherapy the patient developed osteoradionecrosis. The necrotic bone had

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to be removed surgically and the mandible was reconstructed with a third microvascular graft harvested from the scapula. The problem on this occasion was that both sides of the neck had undergone neck dissection and the availability of donor vessels was limited. The situation was further complicated by the deleterious effects of radiotherapy on soft tissues. In order to forestall problems of vascularisation the graft was anastomosed directly to the carotid bulb and the venous return was connected to the cephalic vein in the right arm.

The operative procedure carried known risks which materialised over the next week; the flap failed leaving a necrotic infected neck (Fig. 1). The principle risk was that the emulsifying effect of infection would lead to rupture of the common carotid artery. It was imperative that the infection and necrotic tissue be removed but the wound could not be debrided manually due to the fear that the weakened area around the anastomosis on the carotid would rupture. Consequently the wound was washed 4-hourly with 3% HP solution (10 vols) mixed 50:50 with saline and in between washings the wound was packed with gauze lined with 1% HP cream (Fig. 2). The progress of the wound is shown over a period of four weeks (Fig. 3). HP solution was used directly on the open neck and the exposed carotid artery and slowly promoted granulation tissue that covered the great vessels. The healthy tissue was subsequently covered by a pectoralis major in August 2008 (Fig. 4).

CLINICAL CASE 2

Mr TH, a 62-year-old male, had a small SCC of the scalp that had been locally excised on three occasions but which eventually invaded the underlying cranium. The patient was referred to Guy's Hospital for combined treatment with the neurosurgeons (Fig. 5). Radiological investigations demonstrated that the SCC had breached both cortices of the skull and was invading the dura (Fig. 6). The area of scalp infiltrated with tumour was widely excised together with a portion of the skull and dura. This was followed by mesh reconstruction of the bony defect and a local scalp flap transposed to cover the defect. HP solution (3% mixed 50:50 with saline) was used in the operation to debride the

Fig. 3 Progress of the wound

Fig. 4 The healthy tissue was subsequently covered by a pectoralis major

wound and dura (Figs 7-8). The solution aided haemostasis, and reduced the chance of infection. It is unclear if HP had any tumouricidal effects.

DISCUSSION

HP solution has a number of weak oxygenating and disinfection attributes which makes it the product of choice in certain circumstances. This is particularly true when tissues are delicate and will not endure rough handling in the process of debridement. One of the problems now facing the oncology surgeons is that with improved cure rates it is the late complications of treatment that are posing significant challenge. The combination of surgery and radiotherapy produces a most unfavourable tissue response with

dense scarring and tissue ischaemia. This makes any further surgery a challenge. The tissues are also prone to necrosis and infection. In the head and neck one of the main concerns in this situation is a carotid rupture. The value of HP cream is that it liquefies necrotic tissue and the effervescent solution gently lifts debris from the wound with minimal trauma. The high oxygen release is also effective against gram negative bacteria which are common in necrotic tissue.

The same gentle debridement effect is useful in fresh wounds such as the cranium or oral cavity where it removes tissue and aids haemostasis. HP is routinely used by neurosurgeons as an aid to haemostasis after intracranial tissue resection.^{4,5} HP has also been used intra-operatively by

Fig. 5 The patient was referred to neurosurgeons for combined treatment

Fig. 6 Radiological investigations demonstrated that the SCC had breached both cortices of the skull and was invading the dura

surgeons elsewhere in the body to contain tumour cells in the resection margin (breast, liver etc).⁶

Modern dentistry is focused on developing a conservative approach to dental care. HP has a valuable role in minimally invasive dentistry although it has been speculated that high HP concentration may cause microscopic damage to teeth. This has never been shown to be the case. A gel of 10% carbamide peroxide (CP) releases about 3% hydrogen peroxide. This is the same percentage as that used in the above clinical cases. It has been shown that even high concentrations of CP do not alter enamel structure.⁷

The literature has strong supportive evidence for the safety of dilute HP in dentistry. A large range of concentrations have been used and have been effective. Concentrations as high as 35% HP have been shown to be effective in both clinical and laboratory studies but have to be used with care to avoid soft tissue burns. In contrast low dose HP mouthrinses (1.5%) have been used for long period of times (18 months) in orthodontic patients with no mucosal irritation⁸ and in reality are available as a mouthrinse (Peroxyl, Colgate Palmolive, Guildford).

All clinicians are aware of the positive use of HP but its place in dentistry remains controversial. This is due to two reasons. One is the legislation surrounding HP and secondly the fear the clinicians have of causing tissue damage from its use. Despite the legislation HP is used widely but surreptitiously thereby limiting its use. The use of HP is sensitive

Figs 7–8 HP solution (3% mixed 50:50 with saline) was used in the operation to debride the wound and dura

on delicate tissues as illustrated above. This should act as a reassurance against the risks of inadvertent tissue damage if guidelines are followed correctly. The evidence suggests that bleaching with 10% CP (about 3% HP) is a safe procedure.⁹⁻¹³

CONCLUSION

Hydrogen peroxide, as with all other medical products, has advantages and disadvantages. The objective is to gain the maximum benefit from this product. The present cases serve to illustrate the use of HP in much more precarious situations than usually encountered in the oral cavity. The alternative to bleaching teeth with 10% carbamide peroxide in customised bleaching trays is resorting to destructive techniques such as porcelain veneers.

A refreshing amount of common sense was deployed by the Chief Dental Officer in 2000 when confirming the technique of bleaching was legal and 'The Department of Health would not seek to interfere with a dentist's therapeutic decision to utilize a bleaching technique where a dentist considered this to be in the best interests of the patient's overall oral health care.'¹⁴

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