Accidental intraoral formalin injection: a rare case report

Ramakant Dandriyal, Kolly Yada Giri, Sarwar Alam, Aishwarya Pratap Singh

Department of Oral and Maxillofacial Surgery, Institute of Dental Sciences, Bareilly, India

Abstract

Formalin is a hazardous chemical that needs cautious handling and special storage.

Owing to its disinfectant and fixative (*i.e.* for preserving pathologic tissue specimens in histopathology) properties, it is widely used in dentistry. Although, the terms formaldehyde and formalin are often confused as being identical, these are different as to the concentrations of the primary component *i.e.* formaldehyde. In fact, the common fixative available as 10% neutral buffered formalin is actually a 4% solution of formaldehyde (*i.e.*, a 10% solution made from a 37-40% commercially pure formaldehyde solution). This case report describes an unfortunate case of accidental injection instead of local anesthetic, of formalin into the pterygomandibular space in a 35-year old woman during inferior alveolar nerve block for surgical removal of impacted lower right third molar and its successful management by cautious debridement (under both local and general anesthesia) and empirical drug therapy (utilizing analgesics and antibiotics).

Introduction

Formalin is widely used in dentistry, owing to its disinfectant and fixative (*i.e.* for preserving pathologic tissue specimens in histopathology) properties.[1] Formaldehyde is a colorless, flammable gas at room temperature with a characteristic pungent odor.[2] It has been used in clinical, diagnostic and research laboratories as a preservative or tissue fixative for over a century.[3,4] The tissue fixation properties of formalin are a result of formation of cross-links between soluble and structural proteins in specimens subjected to it. The resulting structure retains its cellular constituents in their in-vivo relationships and is able to withstand subsequent processing (*e.g.*, immunohisto-staining, specimen grossing) since fixation imparts it an increased degree of mechanical strength.[5] Formaldehyde is typically available as dissolved in a water and methanol, a solution called *formalin*, or in a powder form called paraformaldehyde. Both are capable of releasing formaldehyde gas,[6] the active principle which is responsible for the above noted properties. The terms formaldehyde and formalin are often used interchangeably, but a fixative labeled as 10% buffered formalin is in fact a 4% solution of formaldehyde (*i.e.*, a 10% solution made from a 37-40% commercially pure solution of formaldehyde).[1] Formalin can enter the body by either ingestion or inhalation. Once ingested, the metabolism of formaldehyde is similar to that of methanol with formic acid as an intermediate that accumulates within the body leading to fatal metabolic acidosis.[7] According to studies, ingestion of 50-100 mL of formaldehyde will lead to myocardial depression.[8] There is little information available on the extent of formaldehyde absorption in mammals and little data available regarding its conversion to formic acid and carbon dioxide in humans. Patients accidentally exposed to formalin into the intravascular compartment have developed acute hemolysis. Other causes of death following formalin ingestion include metabolic acidosis, circulatory shock and disseminated intravascular coagulation. *In vitro* studies have shown that formalin has direct oxidant action on red blood cells.[9] However, cases of intentional consumption (as in suicides or attempted suicides) have presented with entirely different set of clinical features like oro-facial and pharyngeal burns, gastrointestinal symptoms like corrosive gastritis with hematemesis, dysphagia, inhalational pneumonitis with cough, dyspnea, cyanosis and cardiac arrhythmias.[10,11] Humans exposed to excess of formaldehyde (gas), show several symptoms including respiratory irritation; watery, itchy eyes; itchy, runny, or stuffy nose; dry or sore throat; and headache. The Occupational Safety and Health Administration (OSHA) recognizes that contact with formaldehyde can cause skin irritation and dermatitis.[12] The very few reports available demonstrate marked accumulation of formic acid, after ingestion of formaldehyde.[1] The fatal dose of formaldehyde after oral ingestion is approximately 50-100 mL, however usually exposure of this magnitude is encountered in suicide cases.[8] In dentistry, there was a case reported in literature where formalin solution was accidentally used as an irrigating solution during third molar surgery instead of isotonic saline solution.[13] Injection of formalin into the pterygomandibular space however represents a unique case and lends an opportunity to analyze the corrosive effects of this chemical and havoc it may wreck in the dental practice upon casual handling.

Case Report

A 35-year old female patient reported to the Department of Oral and Maxillofacial Surgery with the chief complaint of pain in the lower right back tooth region of the lower jaw. The clinical and radiographic examination showed the lower right third molar to be impacted and surgical removal of the same was planned. Case history was documented. Patient's general condition was fine and routine blood investigations were performed which were in normal limits. The surgical removal of the impacted lower right third molar was planned under local anesthesia and the case was assigned to a resident doctor. After pre-surgical aseptic procedures, the resident in charge loaded the syringe for injecting local anesthetic with 2.5 mL clear liquid in a vial which he assumed was local anesthetic solution. Within minutes after the injection was made (approximately 2 min), the patient started complaining of sharp burning pain and a feeling of intense discomfort at the site of injection. The procedure was stopped immediately. A quick clinical examination followed including monitoring of the vital signs which were within normal limits. The resident reported immediately to the consultant who examined the contents of the vial from which the syringe was loaded. A cursory examination revealed that the vial contained a clear liquid having an offensive pungent odor (resembling that of cadaveric chambers in anatomical dissection halls). Immediate surgical exploration of the site was planned under local anesthesia in order to limit the necrotic tissue damage. The pterygomandibular space was approached intraorally and extensive exploration and meticulous debridement were carried out along the track of possible chemical trickle down, a corrugated rubber drain placed and prophylactic broad spectrum antibiotics along with analgesics were prescribed for 7 days. While discharging, the patient was

Correspondence: Sarwar Alam, 19, Staff Residence, Institute of Dental Sciences, Pilibhit Bypass Road, Bareilly-243006, UP, India.
E-mail: sarwaralam@rediffmail.com

Conflict of interests: the authors declare no potential conflict of interests.

Key words: formalin, pterygomandibular space, Ginwalla's approach, formaldehyde toxicity.

Received for publication: 15 July 2014.
Accepted for publication: 30 September 2014.

This work is licensed under a Creative Commons Attribution NonCommercial 3.0 License (CC BY-NC 3.0).

©Copyright R. Dandriyal et al., 2014
Licensee PAGEPress, Italy
Clinics and Practice 2014; 4:686
doi:10.4081/cp.2014.686

instructed to maintain good oral hygiene by using 15 mL povidine-iodine gargles twice to thrice daily. The patient was recalled on the fifth post operative day and the drain was removed. The patient didn't however, report for any further follow ups for up to 26 days. After 26 days, the patient reported with swelling and discharge on the right submandibular region and limited mouth opening. The swelling was soft in consistency, with intermittent pus discharge. The discharge was collected and sent for culture and sensitivity. Interincisal distance at this time was measured and recorded as 15 mm. Orthopantomogram (OPG) and computed tomographic (CT) scans were advised. The OPG showed slight radiolucency in the angle region on the affected side, changes suggestive of osteolysis (Figure 1). The CT scan on the affected side showed bulky medial pterygoid muscle with irregular margins and exhibited low attenuation. Anteriorly, an obliteration of fat plane *i.e.* fatty infiltration and diffusion was evident. Clinically correlated, these changes were suggestive of active inflammation of the medial pterygoid and subsequent necrosis (Figure 2). The patient was admitted and empirical intravenous antibiotics were started and the same were continued as no growth was reported on the pus culture and sensitivity. A surgical intervention and re-exploration were planned under general anesthesia at this stage based on clinical and radiographic investigations. During the surgical procedure, the patient was intubated by fiber optic intubation due to decreased mouth opening. A submandibular incision was placed and the angle region exposed. Upon exploration, the right medial pterygoid muscle attachment on the medial aspect of angle of mandible was found to be necrosed (Figure 3). The site was then simultaneously carefully exposed intra orally using Ginwalla's anterior border of ramus approach (Figure 4) and necrotic muscle tissue was excised. Following surgical excision of the necrotic medial pterygoid muscle the surgical wound was closed intraorally with 3-0 vicryl and submandibular incision was closed in layers with 3-0 vicryl and skin with 4-0 prolene. The patient had an uneventful recovery and was discharged free of symptoms on the 6th post operative day. Gradually the mouth opening improved by the end of 2nd month and the patient is completely asymptomatic after 1 year of follow up.

Discussion and Conclusions

The number of similar incidences reported in the literature may be very low and the present case might even be one of its kinds, as far as maxillofacial region is concerned owing to obvious malpractice and litigational considerations as far as patient co-operation after such a mishap is concerned. The frequent use of empty local anesthetic vials for preserving and transferring biopsy specimens instead of separately labeled biopsy bottles in academic settings in India (in order to cut costs) is also one major factor responsible for such mishaps. A similar case was reported by Durga *et al.* in 2011 wherein formalin was accidentally injected in a similar fashion while performing a dental extraction.[14] These cases, although despicable, provide a unique chance to study the effect

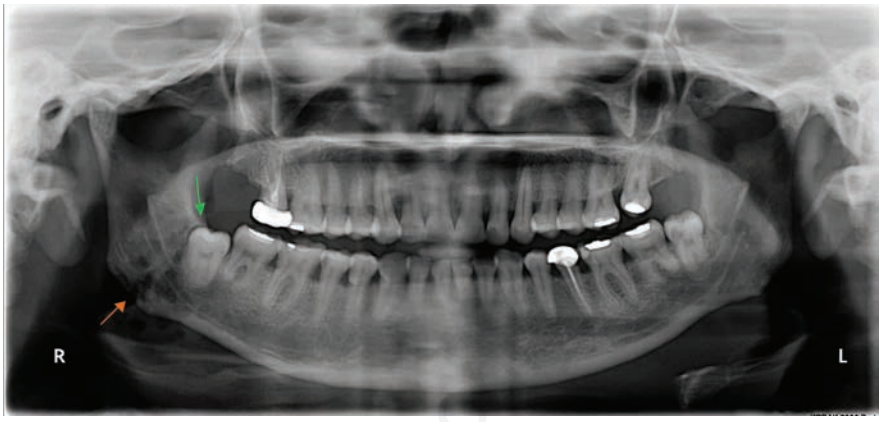


Figure 1. Orthopantomogram demonstrating osteolytic changes around the right angle region (orange arrow). Also, the wisdom tooth which was planned to be extracted is seen (green arrow).

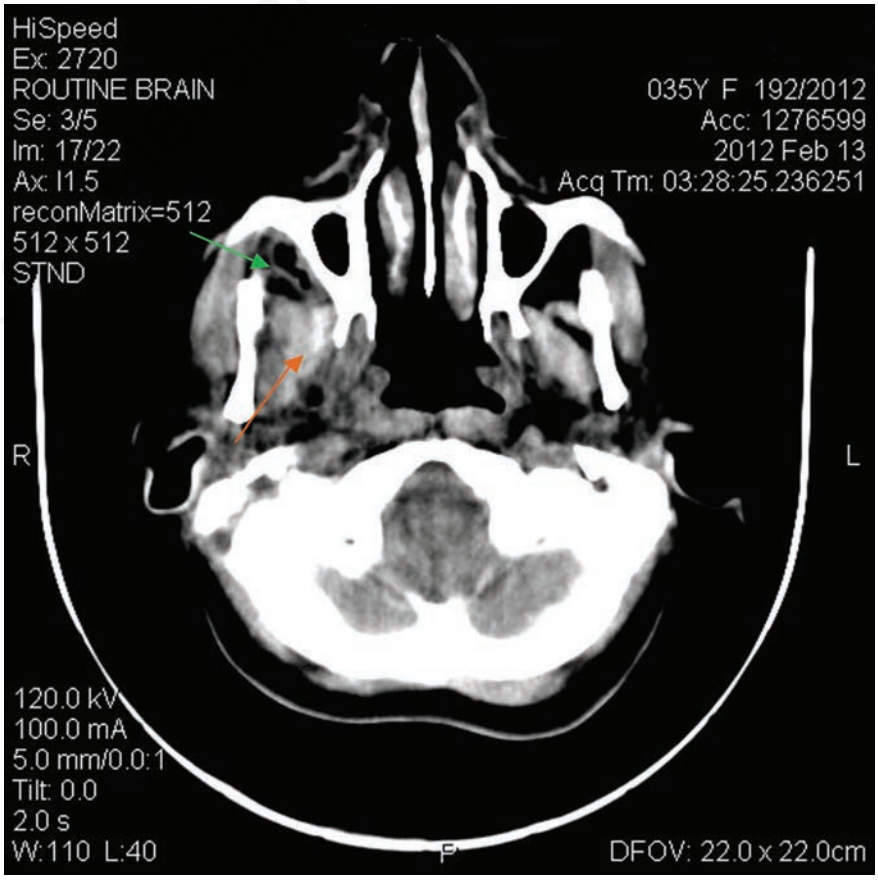


Figure 2. Computed tomographic scan showing irregular and bulky medial pterygoid (orange arrow) and obliteration of fat plane (green arrow). Changes suggestive of cellulitis and fatty infiltration with necrosis of the medial pterygoid muscle.

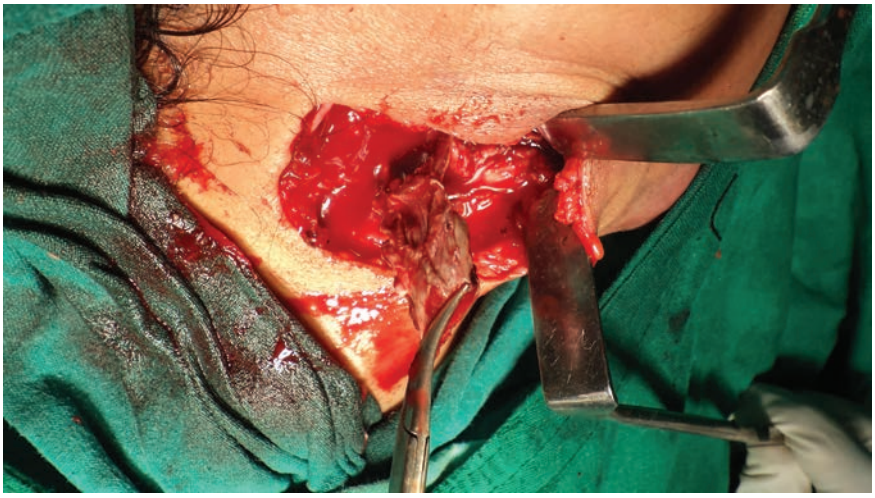


Figure 3. Necrotic medial pterygoid mass being surgically exposed through extra-oral submandibular approach.

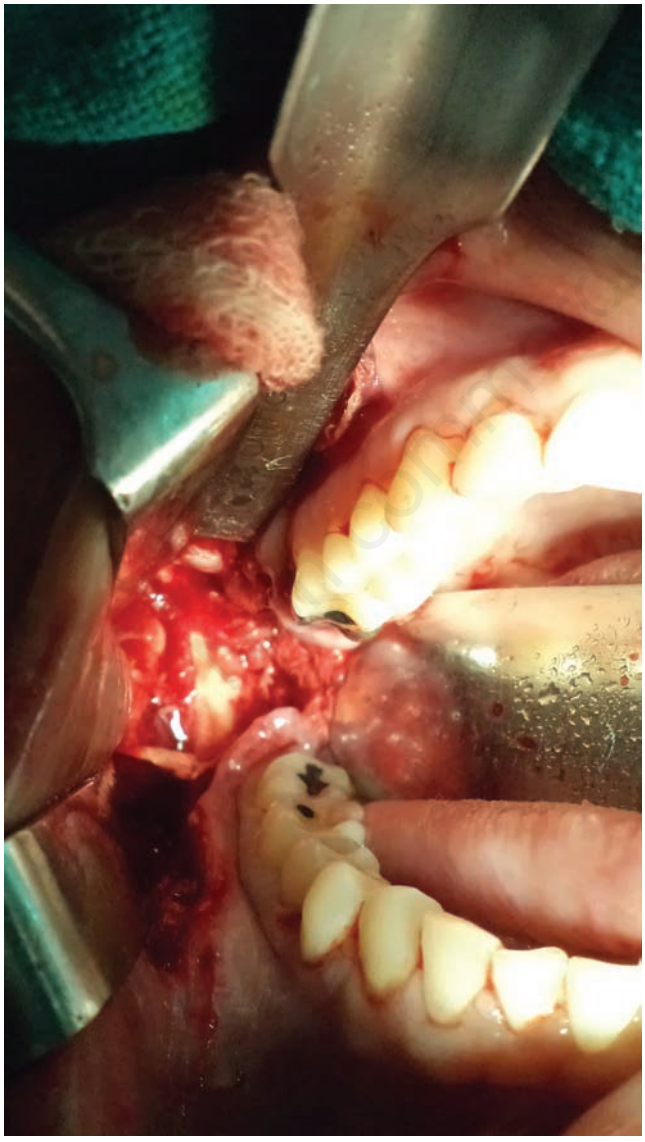


Figure 4. Use of intraoral (Ginwalla's) approach to aid in the excision of the necrotic medial pterygoid.

of such corrosive chemicals on the maxillofacial region and also contributes towards the available body of literature regarding the best possible management of the patient, shall such a case be ever encountered. Although no laid down guidelines exist about the management of patients with intracorporeal formalin injections, good results were achieved with surgical exploration and excision of necrotic medial pterygoid muscle in the present case. In a dental setting especially, several colorless chemicals like normal saline, formalin, hydrogen peroxide, hypochlorite are often simultaneously used, thereby necessitating proper labeling and separate storage and shelving for each one. The frequent fumigation of the operatory with formaldehyde and potassium permanganate and the compulsory application of face mask during the surgical procedures probably contribute towards masking the pungent and otherwise offensive odor of formalin solution.[14] In general, local anesthetic solution should be kept away from such corrosive chemicals. These precautions might help to some extent in avoiding such mishaps in the dental office.

References

1. Lian CB, Ngeow WC. The adverse effect of formalin: a warning against mishandling. Ann Dentistry 2000;7:56-8.
2. Casanova M, Heck Hd'A. Further studies of the metabolic incorporation and covalent binding of inhaled [3H]- and [14C]formaldehyde in Fischer-344 rats: effects of glutathione depletion. Toxicol Appl Pharmacol 1987;89:105-21.
3. Hilbert G, Gruson D, Bedry R, Cardinaud JP. Circulatory shock in the course of fatal poisoning by ingestion of formalin. Intens Care Med 1997;23:708.
4. Kochhar R, Nanda V, Nagi B, Mehta SK. Formaldehyde-induced corrosive gastric cicatrization: case report. Hum Toxicol 1986;5:381-2.
5. Burkhart KK, Kulig WW, McMartin KE. Formate levels following a formalin ingestion. Vet Hum Toxicol 1990;32:135-7.
6. Eichler HG, Hruby K, Katschnig MJ, Leinzinger P. Accidental fatal formaldehyde poisoning. Wien Klin Wochenschr 1983;95:243-5.
7. Mc Martin KE, Ambre JJ, Tephly TR. Methanol poisoning in human subjects. Role of formic acid accumulation in metabolic acidosis. Am J Med 1980;68:414.
8. Hilbert G, Gruson D, Bedry R, et al. Circulatory shock in the course of fatal poisoning by ingestion of formalin. Intens Care Med 1997;23:708.
9. Pun KK, Yeung CK, Chan TK. Acute intravascular hemolysis due to accidental

formalin intoxication during hemodialysis. Clin Nephrol 1984;21:188-90.
10. Rajan N, Rahim R, Krishna Kumar S. Formic acid poisoning with suicidal intent: a report of 53 cases. Postgrad Med J 1985;61:35-6.
11. Roy M, Calonje MA, Mouten R. Corrosive gastritis after formaldehyde ingestion. N Engl J Med 1962;266:1248-9.
12. Occupational Safety and Health Division - N.C. Department of Labor. A guide to formaldehyde. Raleigh, NC: NCDOL; 2013. Available from: http://www.nclabor.com/osha/etta/indguide/ig31.pdf
13. Lian CB, Ngeow WC. Formalin mishandling during wisdom tooth surgery. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998;86:630.
14. Durga SG, Shilpi S, Padam NT, et al. Formalin-induced iatrogenic cellulitis: a rare case of dental negligence. J Oral Maxillofac Surg 2011;69:e525-7.

Non commercial use only