

Dental pain management – a cause of significant morbidity due to paracetamol overdose

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Key points

Highlights that paracetamol dosages in common OTC medicines are not fully appreciated by patients and dentists.

Suggests that managing the primary cause of pain emergently can reduce the risk of significant morbidity (overdose and significant neck abscess).

Advises dentists to prioritise pain management cases over elective cases to prevent this overdose issue developing.

Highlights that dentists should be aware of the risk of overdose and advise urgent referral if suspected.

Background Self-medication with paracetamol is common for management of dental pain. Inadvertent paracetamol overdose remains a major public health problem requiring emergency hospital admission, reversal of hepatotoxicity with N-acetylcysteine (NAC) and fluid resuscitation, maxillofacial referrals and potential admission to acute liver units. This retrospective study analysed patients attending the emergency department in a university teaching hospital to determine whether dental pain is a contributory factor in accidental paracetamol overdose and to establish the cost and burden on secondary care services as a result. **Method** Data collection was carried out by reviewing EDIS (Emergency Department Information System) clinical entries for patients attending over a two-year period (1 May 2014 – 30 April 2016 inclusive). **Results** Four hundred and thirty-six cases presented to the emergency department with accidental paracetamol overdose, 164 of which were a direct result of dental pain. Of the dental cases, 61.5% (101) of patients required medical admission, 33% (54) were discharged and 5.5% (9) either self-discharged or refused treatment. Females accounted for 58% (95) of cases, and males 42% (69) with a mean age of 33 years (range 4–71 years). A ratio of 2:1 weekday/weekend attendances was observed. Fifty-five percent (90) had contacted their dentist before presentation, 14% (23) had contacted 111 (the NHS emergency and urgent care services telephone number) or the local emergency dental service. Twenty-two percent (36) had not sought emergency dental care, and 9% (15) were unspecified. The on-call maxillofacial team was called in 25% (41) of cases. Thirty-one percent (51) displayed abnormal liver function, 13.4% (22) of cases demonstrated elevated white cell count suggesting possible dental infection. Five patients (3%) were pregnant at the time of presentation. **Conclusion** Dental pain contributes to a significant number of acute medical admissions as a result of accidental paracetamol overdose. These results highlight a lack of public awareness surrounding safe self-medication and inadequate access to timely emergency dental care, which in this cohort appears to be primarily during the working week.

Introduction

The aims of this study were to establish the level of contribution of dental pain to the problem of paracetamol overdose and to highlight the ramifications of delayed access to emergency dental care.

Self-medication with over-the-counter analgesia is a common and well-documented practice among patients with dental pain,¹

with some studies suggesting self-medication practice may continue for up to six months before seeking dental care.² Paracetamol (acetaminophen) remains the analgesic of choice for dental patients in the UK, a choice driven by self-preference rather than medical or financial reasons.¹ In contrast, analgesic selection among dental patients in the United States has shifted towards ibuprofen in recent years.³

There is published evidence to suggest dental pain is the leading cause of unintentional paracetamol overdose,⁴ with abdominal pain, headache, dysmenorrhoea and musculoskeletal pain also major contributors.⁵ Public awareness surrounding the dangers of excessive consumption of over-the-counter analgesia appears to be lacking. A study carried out at Glasgow Dental Hospital in 2014 showed that

71% of dental clinicians surveyed were unable to quantify paracetamol overdose levels, and a similar percentage were unfamiliar with many paracetamol-containing preparations.⁶ This suggests a suboptimal level of knowledge among dental professionals in the area of safe self-medication with analgesia. Despite this issue having been highlighted previously, our work shows that access to emergency dental care remains a contributing factor.⁴

Method

This study was carried out at a major teaching hospital providing both secondary and tertiary care services. Data collection for this study was facilitated by the Acute Medical Records Business Analysis team. Clinical coding

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Table 1 Cause of pain

Cause of pain	%
Periapical infection	56
Post-operative	21
Dental abscess	17
Pericoronitis	5
Trauma	1

isolated dental cases of accidental paracetamol overdose. Clinical entries, together with discharge summaries and biochemistry results were used to extract the following data: gender, date of birth, nature of dental pain, paracetamol dose ingested, plasma paracetamol level, type of overdose (single time-point versus staggered), maxillofacial surgery involvement, whether or not the patient was admitted to acute medical unit, and blood results (AST, ALT, INR, PT, bilirubin). Data were entered into Microsoft Excel for analysis.

Results

Over a twenty-four month period (1 May 2014 to 30 April 2016 inclusive), a total of 436 cases of accidental paracetamol overdose presented to the emergency department (ED). One hundred and sixty-four (38%) of these cases were directly related to dental pain, figures comparable to those cited in a previously reported case series.⁴

Females accounted for 58% of cases, compared to 42% male. The mean age of patients was 33 years (range 4–71 years). The youngest patient suffered dental trauma and overdose was a result of lack of parental awareness of safe paediatric dosing with paracetamol suspension. There was a 2:1 ratio of weekday versus weekend attendances.

The nature of the dental pain is highlighted in Table 1. Fifty-five percent of patients were registered with a general dental practitioner, with whom they were unable to secure a timely emergency appointment. A further 14% of cases had contacted either '111' or the local emergency dental service, but were found to have ingested excessive quantities of paracetamol and were subsequently re-directed to ED for assessment (see Table 2).

Admission to the acute medical unit was required in 61.5% of cases. A further 33% were discharged from ED, with 5.5% either self-discharging or declining treatment. The mean length of stay was 1.22 nights; the longest

Table 2 Access to emergency dental services prior to ED attendance

Background	%
Contacted GDP	55
Contacted 111/Emergency Dental Services	14
No emergency care sought	22
Unspecified	9

stay was four nights. A total of 123 hospital nights was observed in this study. The highest reported quantities of paracetamol ingestion included 128 g over 4 days, 117 g over 2 days and 672 g over 7 days (maximum safe dose of paracetamol is 4 g per day in adults weighing 50 kg or above).

Sixty-three percent of patients received intravenous infusion of Parvolex (N-acetylcysteine) to reverse the toxic effects of excess paracetamol ingestion. The on-call maxillofacial team was called to review 25% of cases; treatment consisted primarily of nerve blocks, incision and drainage of dental abscess or tooth extraction. However, in the majority of cases, patients opted to see their general dental practitioner for treatment following discharge from hospital.

Discussion

Paracetamol is a cheap, readily available analgesic that is effective in the management of mild to moderate pain, and is safe when consumed at recommended doses. It is the most commonly consumed drug in overdose in the UK, and has been shown to account for

9% of drug-related suicides.^{7,8} Paracetamol poisoning is the single most common cause of acute liver failure in the UK, Europe, North America and Australia.^{5,6,9} There is a plethora of paracetamol-containing preparations on the market today; this compounds the issue of paracetamol overdose as many people will be unfamiliar with the constituents of compound analgesic preparations⁶ (see Table 3).

Paracetamol is well absorbed orally, and undergoes metabolism primarily in the liver. Peak plasma concentration is reached approximately four hours following ingestion. Hepatotoxicity may arise following a single ingestion of more than 150 mg/kg paracetamol taken in less than one hour. However, doses as low as 75 mg/kg can result in hepatotoxicity where there are pre-existing risk factors, such as malnutrition, anorexia, alcoholism and concurrent liver-inducing medication.⁹ Paracetamol overdose is treated by intravenous infusion of N-acetylcysteine which is virtually one hundred percent effective when administered within eight hours of ingestion, after which effectiveness declines substantially.^{10,11}

Nausea and vomiting are the only early signs of paracetamol poisoning, and usually settle within 24 hours of onset.¹¹ Concomitant development of right subcostal pain and tenderness usually signals the onset of hepatic necrosis. It is therefore important that dentists recognise the early warning signs and promptly refer all suspected cases for urgent medical assessment.

Following a review by the Commission on Human Medicines (CHM), new guidelines for the management of patients with paracetamol overdose were introduced in September 2012 by the Medicines Health and Regulatory Agency

Table 3 Paracetamol containing preparations

Drug name	Paracetamol	Other constituents
Lemsip Cold & Flu	650 mg	Phenylephrine hydrochloride 10 mg
Beecham's Cold & Flu sachets	600 mg	Phenylephrine 10 mg
Solpadeine Plus	500 mg	Codeine 8 mg Caffeine 30 mg
Co-codamol	500 mg	Codeine phosphate 8/15/30 mg
Co-dydramol	500 mg	Dihydrocodeine 10 mg
Anadin extra	200 mg	Aspirin 300 mg Caffeine 45 mg
Paramax	500 mg	Metoclopramide hydrochloride 5 mg
Migraleve	500 mg	Bucizine hydrochloride 6.25 mg Codeine phosphate 8 mg
Benylin Cold & Flu Max Strength Capsules	500 mg	Phenylephrine 6.1 mg Caffeine 25 mg

(MHRA).^{10,12} The abolition of risk factor assessment in determining treatment need has simplified patient management. A study conducted at University Hospital Galway in 2013 found that the introduction of the new guidelines resulted in only a modest increase in the number of overdose patients requiring treatment.¹³

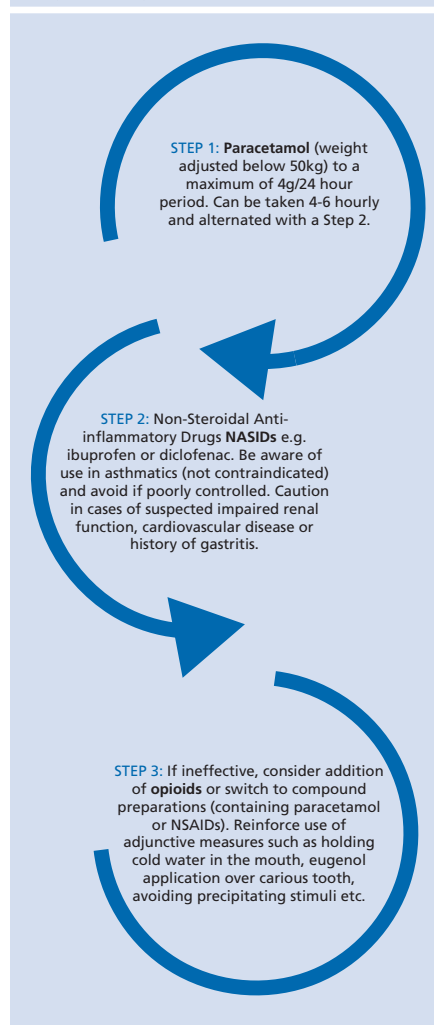
Current guidance recommends treatment with NAC in all cases of staggered overdose.^{10,12} A staggered overdose describes the ingestion of two or more supratherapeutic doses over an 8-hour period or greater, resulting in a cumulative dose of more than 4 g in a 24-hour period; conversely, a single-time point overdose is the ingestion of a single dose of 4 g or more at a defined point in time. Staggered overdoses have been shown to carry a much higher mortality rate than single time-point overdoses, with a greater incidence of encephalopathy and hepatic and renal injury, despite lower total ingested paracetamol concentrations.⁵ Ninety-eight percent of overdose cases in this study were staggered, which suggests this cohort of patients is at particularly high risk of systemic effects. Hypersensitivity reactions to NAC are estimated to occur in approximately 6–23% of cases,⁹ and usually arise within the first hour of initial infusion. In this study, 3% of patients suffered an allergic reaction, with documented symptoms including rash, dizziness and nausea. The Health Products Regulatory Authority (HPRA) advises against withholding NAC even in cases of previous anaphylactoid reactions.¹⁰

With the cost of an overnight hospital stay on the NHS estimated at £400, a substantial cost burden has been imposed on secondary care services, before accounting for biochemistry costs (baseline and post-infusion), staffing, NAC treatment etc. This cost burden is arguably a preventable one; had these patients received prompt emergency dental care, their pain could have been treated without resort to excessive consumption of analgesia.

The involvement of the maxillofacial team is likely underestimated in this study owing to the use of a remote clinical records system by ED personnel. The decision to treat these patients, and mode of treatment provided, should be based on clinical judgement. Toxbase guidance suggests withholding invasive treatment until a normal blood film is detected with no evidence of hepatic dysfunction.¹²

The Scottish Dental Clinical Effectiveness Programme (SDCEP) has published two documents, 'Emergency Dental Care'¹⁴ and

Fig. 1 Analgesia sequence for dental pain



'Drug Prescribing for Dentistry',¹⁵ published/reviewed in 2007 and 2016, respectively, which provide a systematic approach to odontogenic pain management in the dental setting. The WHO analgesic ladder, originally developed in 1986 for cancer patients, has also been adapted for management of acute pain.¹⁶ It recommends a three-step approach to pain management: non-opioids (eg, paracetamol, ibuprofen) should be prescribed in the first instance, stepping up to weak opioids (eg, codeine) or strong opioids (eg, morphine) where pain is persisting. However, for dental pain, the evidence points to superiority of non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol over opioids at conventional doses.^{11,17} These analgesics should be considered the mainstay for dental pain management in the general practice setting.

Offering tailored advice will help keep patients comfortable until the dentist can facilitate an appointment, thereby preventing many of these overdose cases. This also holds true

for effective post-operative pain management. Analgesia advice should be routinely offered as part of post-operative care; where paracetamol and/or NSAIDs are not tolerated, appropriate alternatives should be prescribed by the GDP, together with a written leaflet warning of the safe maximum oral doses of the analgesic(s) in question. The chart to the left (Fig. 1) provides a summary of analgesia optimisation for both primary and secondary care clinicians.

With an average of at least three individuals presenting each week to this emergency department alone having overdosed with paracetamol as a direct result of toothache, this represents a very large cohort of patients requiring medical management that is largely avoidable.

Conclusion

This study highlights two main findings: a barrier to accessing timely emergency care in the general dental practice setting, and a lack of practitioner and public awareness surrounding safe analgesia. These results clearly show the onus of the GDP to accommodate patients with emergency dental appointments is failing to mitigate this scenario. Over half of the patients in this study were unable to secure a timely appointment with their registered GDP. A quarter of the patients were suffering the effects of post-operative pain. Every effort should be made to facilitate patients requiring acute dental care, or at the very least offer effective advice on optimisation of analgesia. Dentists have a duty of care to treat patients in need of emergency care in a timely manner to prevent significant morbidity and financial fallout to the NHS as a result of paracetamol overdose.

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