

Paracetamol overdose secondary to dental pain: a case series

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IN BRIEF

- Highlights the significant morbidity experienced by patients admitted to hospital after paracetamol overdose secondary to dental pain.
- Highlights the barriers experienced by patients in accessing timely dental care for acute dental pain.
- Suggests the majority of paracetamol overdose cases secondary to dental pain could have been prevented and managed before analgesia overdose.

Introduction There have been documented cases of serious and life-threatening health effects due to patients taking unintentional analgesia overdose secondary to dental pain. We aimed to determine firstly what proportion of unintentional paracetamol overdose cases admitted to an acute medical assessment unit (MAU) were secondary to dental pain, secondly what proportion of such cases encountered barriers to accessing emergency dental care and finally what clinical burden such cases placed on the hospital services. **Method** The clinical coding department provided information to allow appropriate identification and data collection from patient discharge summaries and case notes of all unintentional paracetamol overdose cases secondary to dental pain over a 24 month period (1 March 2012 to 28 February 2014). **Results** One hundred and sixteen admissions were identified specifically for unintentional paracetamol overdose. Dental pain accounted for 48 (41%) of all cases. Females (67%) were twice as likely to be admitted, compared to males (33%), with a mean age of 36 years and four months. Thirty-two (63%) non-dentally registered and all nine (100%) registered patients were unable to access timely emergency dental care before their admission. Forty cases (83%) were referred to the hospital oral and maxillofacial services (OMFS). Thirty-seven (93%) patients underwent elective outpatient dental extractions and the remaining three (7%) patients were admitted for intravenous antibiotics, incision and drainage and dental extractions. All patients were treated under local anaesthetic. **Conclusion** Dental pain is the single most common cause of acute medical admission secondary to unintentional paracetamol overdose. Patients registered with a general dental practitioner (GDP), as well as those not registered with a GDP, had difficulty accessing timely emergency primary dental care.

INTRODUCTION

Patients frequently present to hospital emergency departments due to inadvertent non-prescription analgesia overdose. There have been documented cases of adverse health effects as a result of paracetamol overdose secondary to acute dental pain.^{1,2} It has been found that patients with dental pain are at increased risk of accidentally overdosing paracetamol compared with patients taking paracetamol for other reasons.³ Use of non-prescription analgesia for dental pain is common³⁻⁵ and it is known that public awareness of safe paracetamol consumption is poor.⁶⁻⁹

A report investigating barriers to accessing primary dental care in the United

Kingdom revealed that 7% of adults were unsuccessful in securing an appointment with an NHS dentist and 19% of adults delayed recommended treatment due to associated costs of the procedure.¹⁰ Due to the increasing difficulty in public access to primary care dental services, there may be a potential for a greater proportion of the population relying on non-prescription analgesics such as paracetamol to relieve their symptoms. This may have an impact on the number of patients presenting acutely to hospital due to paracetamol overdose secondary to acute dental pain. Subsequently, this may place a burden on the hospital oral and maxillofacial service (OMFS) in treating the primary cause of the overdose.

The aims of the study were to firstly determine what proportion of patients admitted to a medical assessment unit (MAU) were a result of unintentional paracetamol overdose secondary to acute dental pain. Secondly, to assess whether such patients had experienced dental access problems and finally whether such cases created a clinical burden on the hospital OMFS.

METHOD

The study was undertaken at the Northern General Hospital, Sheffield. The hospital is part of the largest NHS Foundation Trust in the UK with over 1,100 beds. It provides the city with its acute medical services, with its adult emergency department receiving over 100,000 attendances per year.¹¹

The clinical coding department provided details of all patients admitted to the acute MAU due to unintentional paracetamol overdose from all cases between 1 March 2012 and 28 February 2014. The coding list was used to identify appropriate MAU electronic discharge summaries of cases of unintentional paracetamol overdose secondary to a dental cause. Missing discharge summaries or summaries unclear about the nature of paracetamol overdose were noted and information was then collected from patient case notes requested from medical records. Case notes irretrievable from medical records were excluded from the study.

Discharge summaries and patient case notes were used to obtain the following data in the selected cohort of patients: basic

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demographics (age and gender); length of hospital stay; clinical interventions; dental registration status; and referral to OMFS with relevant outcomes. Patients were telephoned to obtain information on their dental registration status and care at the time of their admission if records were unclear regarding this.

A structured proforma was used to record the data collected (see Fig. 2).

RESULTS

Between 1 March 2012 and 28 February 2014, a total of 746 patients were admitted to the MAU due to analgesic overdose. One hundred and twenty-six cases were due to unintentional paracetamol overdose; 116 cases were used in data analysis and 10 cases were irrecoverable and so excluded from the study. Forty-eight out of the 116 (41%) unintentional paracetamol overdose cases were secondary to a cause associated with dental pain (Table 3).

Females were twice as likely to be admitted for unintentional paracetamol overdose secondary to dental pain with a mean age of 36 years and four months (range 17 years and three months to 64 years and six months). Sixty-seven percent of non-dentally registered patients were unable to access timely emergency dental care (with a mean delay of four days) to address their dental pain, and all nine of the dentally registered patients were unable to access emergency care (with a mean delay of three days) by their own general dental practitioner (GDP) or an out-of-hours emergency dental service (Tables 1 and 2).

Dental pain was the most common cause of admission for unintentional paracetamol overdose followed by psychiatric conditions and back pain (Fig. 1). Psychiatric causes included conditions such as stress, anxiety, insomnia and depression. However, patient case notes clearly stated that there was no malicious intent for overdose or deliberate self-harm.

Ninety-six percent of patients admitted to the MAU with inadvertent paracetamol overdose secondary to dental pain underwent serum paracetamol toxicity monitoring with 79% requiring active medical management with N-acetylcysteine (Parvolex®). Although the mean hospital stay was one day, one case (2%) of new onset acute hepatic failure required an extended inpatient stay of six days. For the management of the primary cause of the unintentional paracetamol overdose, 17% of patients who were dentally registered were referred back to their own general dental practitioner (GDP) for definitive management of their dental pain, but the remaining majority (83%) of

Table 1 Patient demographics

	Number	Proportion
Male	16	33%
Female	32	67%

Table 2 Registration status

	Number	Proportion
Dentally registered	9	19%
Non-dentally registered	39	81%

Table 3 Proportion of unintentional paracetamol overdose cases secondary to dental pain

	Total	Dental	Non-Dental
Intentional	620	N/A	N/A
Unintentional	116	48	68

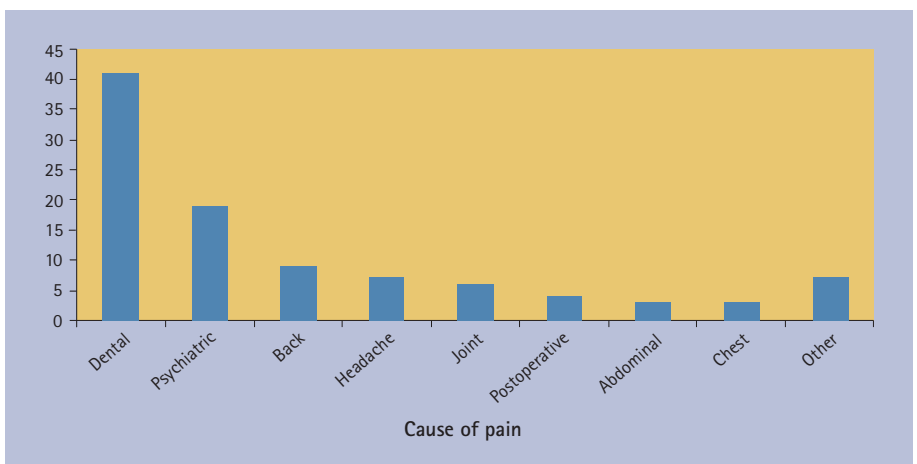


Fig. 1 Precipitating causes of unintentional paracetamol overdose presenting to the Medical Admissions Unit (MAU)

non-registered, and one-registered patient, were referred to the OMFS for dental assessment and appropriate management. The majority (97%) of patients referred to the OMFS underwent elective outpatient dental extractions under local anaesthetic. A total of three patients (7%) were admitted under the care of OMFS where they received a short course of intravenous antibiotic treatment before incision, and drainage and appropriate dental extractions under local anaesthetic. No patients required management of their dental pain under general anaesthetic (Table 4).

DISCUSSION

Paracetamol overdose may occur intentionally or unintentionally. The latter is usually due to the numerous combination products available over-the-counter. After oral administration, paracetamol is well absorbed from the stomach and small intestine, reaching peak plasma concentration in one hour. It is then inactivated by the liver

by conjugation leading to two metabolites; glucuronide or sulphate. Following this, it is excreted through urine. In cases of overdosage, the liver conjugation process becomes inundated and paracetamol is then metabolised by an alternative pathway resulting in a toxic metabolite called N-acetyl-p-benzoquinone imine (NAPQI). This toxic metabolite is inactivated by glutathione to prevent any harm. However, when glutathione stores are depleted to less than approximately 30%, NAPQI reacts with the nucleophilic components of hepatic cells leading to necrosis. Hepatic toxicity is increased in patients with induction of the cytochrome P450 enzyme system through drugs such as rifampicin, phenytoin, carbamazepine and alcohol. Patients with low glutathione reserves due to genetic variation, malnutrition, alcohol intake or other liver diseases are also more susceptible to hepatic necrosis.¹²

After paracetamol overdose, patients are usually asymptomatic for the first 24 hours

Table 4 Hospital progress and management in paracetamol overdose cases secondary to dental pain

	Number	Proportion
Blood drug toxicity monitoring	46	96%
Parvolex® administration	38	79%
Acute hepatic failure	1	2%
Referral to registered GDP	8	17%
Referral to OMFS	40	83%
OMFS management:		
Dental extractions under local anaesthetic	37	93%
Intravenous antibiotics, dental abscess drainage and extractions under local anaesthetic	3	7%

or have nonspecific symptoms consisting of nausea and vomiting. Hepatic necrosis develops after 24 hours (elevated blood transaminase levels, right upper quadrant pain and jaundice) and can progress to acute liver failure. Patients may progress to develop encephalopathy, hypoglycaemia, renal failure and lactic acidosis. Serum paracetamol levels at around 150 mg/kg may cause serious or even fatal adverse effects for many adults. There are few findings on clinical examination until the patient develops acute liver failure, when patients may display signs including jaundice, encephalopathy and a tender hepatomegaly.¹²

After hospital admission, serum paracetamol levels are taken four hours post-ingestion. Immediate serum paracetamol levels are checked if the time of overdose is greater than four hours or if there has been a staggered overdose. In September 2012, the Medicines and Healthcare products Regulatory Agency (MHRA) changed the guidelines on management of paracetamol overdose.¹³ This guidance is now more simplified and includes an updated single line nomogram.¹⁴ Patients who have a timed plasma paracetamol level plotted on or above the line drawn between 100 mg/L at four hours and 15 mg/L at 15 hours

after ingestion are recommended to receive N-acetylcysteine (NAC, Parvolex®). Where there is doubt about the timing of the ingestion (including a staggered overdose over one hour or more), NAC should be given immediately without referring to the treatment nomogram. Cases with acute liver failure are referred to an intensive care unit (ICU) and those requiring NAC to the acute medical unit (AMU). NAC has a number of hepatic protection mechanisms. It acts as a precursor for glutathione, promoting normal conjugation of any remaining paracetamol and also supplies thiols that function as antioxidants. It is virtually 100% effective in preventing liver damage when given within eight hours of ingestion.¹³ The initial dose of NAC is given as an infusion over 60 minutes with full treatment consisting of three consecutive doses. This usually takes 24 hours. Specific weight-related dosing tables are available to guide the health professional.¹⁵ The treatment of patients presenting more than 24 hours after ingestion is controversial. Management is detailed on Toxbase®.

Seventy-nine percent of patients admitted with paracetamol overdose secondary to dental pain required medical treatment to reverse the systemic effects of blood paracetamol toxicity. One (2%) 42-year-old

male developed acute hepatic failure requiring intensive care unit admission for monitoring and management of his grade 1 encephalopathy. He was subsequently discharged following effective medical management and the extraction of his lower left first molar under local anaesthetic after correction of his coagulopathy. Seventeen percent of patients were discharged to their GDP for definitive management of their dental pain, but the majority (83%) were referred to the OMFS for assessment and management of their dental pain. After assessment by the OMFS team, 93% patients were scheduled for elective outpatient dental extractions under local anaesthetic for single or multiple teeth. Seven percent of patients were admitted for a maximum of two days for intravenous antibiotic treatment, incision and drainage of a dental abscess, and subsequent dental extractions under local anaesthetic. No patients referred to the OMFS required management of their dental pain under a general anaesthetic. This represents a burden of care that could have been addressed by appropriate primary care services.

Over a period of 24 months (1 March 2012 to 28 February 2014), dental pain was the primary cause of unintentional paracetamol overdose in 41% of all cases admitted to the MAU. This was the most common cause of unintentional paracetamol overdose followed by psychiatric conditions (not related to self-harm) (19%) and back-pain (9%).

There was difficulty in accessing timely emergency dental care in the vast majority of cases admitted to MAU. Patients that had attempted to contact an out-of-hours dentist and had been unable to gain access to urgent dental treatment included all those who were registered with a GDP (19%) and 63% of those not registered with a GDP. The remaining (18%) non-registered patients did not attempt to contact an emergency dental service before their hospital admission. As a result, paracetamol was taken in excess, consequentially leading to hospital admission. This demonstrates difficulty in

Hospital no	DOB	Gender	Date of Admission	Date of Discharge	Ward on Admission	Ward on discharge	Case of OD	Additional drugs of OD	Paracetamol level	Treatment LA/GA	Liver Damage	Maxfac input	Registered with GDP	No of days attempting to secure GDP appt

Fig. 2 Data caption form

access to emergency dental care in some cases and may illustrate a lack of oral health education in the cohort of patients who had not tried to contact an out-of-hours dentist.

This retrospective case series focuses on acute admissions for those presenting to a medical admissions unit with unintentional paracetamol overdose secondary to a dental origin. From our knowledge, this is the first ever case series on paracetamol overdose related to dental pain requiring acute hospital admission. However, attention must be given to paracetamol overdose cases sharing the same aetiology that were assessed and discharged directly from the emergency department. In addition to this, those cases admitted with analgesia overdose secondary to dental pain not specific to paracetamol must also be considered. This will provide a more objective understanding of the burden of acute dental pain on patients taking an analgesic overdose and presenting to hospital.

CONCLUSION

In this retrospective case series and for the population under study, dental pain is the single most common cause of acute medical admission secondary to unintentional paracetamol overdose. Forty-eight (41%) of unintentional paracetamol overdose cases were secondary to a cause associated with dental pain. This represents a relatively small average of two cases per month with the vast majority not requiring any further oral and maxillofacial referral. Therefore, it is difficult to justify that cases of paracetamol overdose secondary to dental pain requiring hospital admission represent a burden to the hospital oral and maxillofacial service.

Registered and non-registered patients had difficulty accessing timely emergency

dental care to address their complaint. This resulted in excessive paracetamol consumption causing blood toxicity in a significant proportion of patients (96%) as well as one case (2%) of acute hepatic failure which required active medical intervention. Due to the changes in paracetamol overdose guidelines by the Medicines and Healthcare products Regulatory Agency (MHRA) in September 2012, there may have been an overall increase in the number of cases requiring acute medical admissions particularly due to the removal of the 150 mg/kg paracetamol level threshold being lowered to 75 mg/kg.

In the vast majority of cases (81%), patients were not registered with a GDP. This may indicate a lack of education and awareness of the importance of oral health among this cohort of patients. While paracetamol is a common and effective analgesic for the management of acute dental pain within the UK, patients' understanding of the risks of excessive paracetamol ingestion remains poor. Dentists have an important role in the early recognition of unintentional paracetamol overdose cases and directing patients to appropriate timely care to prevent hepatotoxicity and death. An algorithm and training package targeted at dentists in the acute dental pain setting has been developed to help improve early recognition and appropriate referral of paracetamol overdose cases.¹⁶ This will also reduce the costs of secondary care service provision for the management of this preventable cause of paracetamol overdose.

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