Warming lignocaine to reduce pain associated with injection

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Abstract

Objective—To investigate the effect of warming lignocaine on the pain associated with subcutaneous injection.

Design—Double blind, randomised, crossover study.

Setting—Hospital clinic.

Subjects—40 healthy volunteers.

Interventions—Subcutaneous injection with 1 ml of 1% lignocaine at 20°C and 1 ml of 1% lignocaine at 37°C.

Main outcome measures—Pain assessed by linear analogue pain scores and subjects' comparison of pain on injection.

Results—25 subjects (89%; 95% confidence interval 72% to 98%) thought that lignocaine at 20°C was more painful and 3 (11%; 2% to 28%) thought that lignocaine at 37°C was more painful ($p < 0.0001$); 12 subjects did not express a difference. Median pain score for injection at 20°C was 11.00 and at 37°C was 3.25 ($p < 0.001$). Median difference was 8.25 (4.00 to 13.50).

Conclusions—The simple procedure of warming to 37°C reduced the pain associated with subcutaneous injection of lignocaine.

Introduction

Infiltration of the skin and subcutaneous tissue with local anaesthetic solutions may cause transient pain and discomfort,^{1,2} often proving to be the most unpleasant aspect of a minor surgical procedure. Heating local anaesthetic solutions to body temperature has been suggested as a way of reducing the pain associated with injection. A review of the literature showed considerable disagreement regarding the efficacy of this technique; much of the quoted evidence was anecdotal. We designed a double blind crossover volunteer study to assess any potential benefit gained from warming lignocaine to body temperature before subcutaneous injection.

Methods

The hospital ethics committee's approval was obtained, and all volunteers gave written informed consent. Of 43 medical and paramedical staff asked to participate, 40 agreed. Subjects were aged 26 to 59 years, in good general health, and without known allergy to local anaesthetic agents.

1% Lignocaine was injected subcutaneously with a 25 gauge needle. "Room temperature" lignocaine (20°C) was injected in one forearm and "body temperature" lignocaine (37°C) in the other. Each injection was made over 4-5 seconds. To eliminate bias, the order and the handedness of the two injections was randomised; thus there were four groups of ten volunteers, all volunteers acting as their own controls. The ampoules of lignocaine were maintained at 20°C and 43°C in thermostatically controlled water baths.

A pilot study had shown that prewarming 2 ml ampoules to 43°C and then drawing up 1 ml into a 2 ml syringe resulted in a final temperature of 37°C if the injection was given with 20-30 seconds. A volume of

1 ml was chosen after preliminary investigation showed this to be adequate to enable volunteers to discriminate the degree of discomfort associated with each injection.

Syringes were prepared by one investigator (JAH); the other investigator (SJB), blinded to the temperature of the lignocaine, gave the injections. The syringe was held proximal to the fluid to prevent the investigator sensing the temperature of the solution. Immediately after injection the volunteers (having been told to exclude the pain from the needle insertion) were asked to indicate their discomfort on a 100 mm visual analogue scale, varying from no pain to the worst pain imaginable from injection. After both injections the volunteers were asked to record which of the two injections (if any) had been more painful.

Subjects' assessment of the more painful injection was analysed with the sign test. Linear analogue pain scores were evaluated with Wilcoxon's matched pairs signed ranks test. 95% Confidence intervals were calculated with the confidence interval analysis program.³

Results

Of the 40 volunteers studied, 33 were men. Their ages ranged from 26 to 59 years, with a mean of 34.3 (SD 6.9). Twenty five individuals (89%; 95% confidence interval 72% to 98%) thought that lignocaine at 20°C was more painful and three (11%; 2% to 28%) thought that lignocaine at 37°C was more painful ($p < 0.0001$). Twelve subjects did not perceive a difference. The median visual analogue pain score for injection of lignocaine at 20°C was 11.00, compared with a median score of 3.25 at 37°C ($p < 0.001$). The median difference in visual analogue pain scores was 8.25 (4.00 to 13.50). The order or the initial side of the injection did not influence the pain scores.

Discussion

Boggia first described the practice of heating local anaesthetic agents to reduce discomfort on injection in 1967,⁴ and since then there have been many similar anecdotal reports. Published studies, however, have drawn conflicting conclusion. Bainbridge⁵ and Cragg and colleagues⁶ showed that warming lignocaine significantly reduced the pain of injection, whereas Kaplan and colleagues⁷ and Dalton and colleagues⁸ reported no difference. Only one of these studies, however, was performed double blind,⁷ and in two of the studies there was no standardisation of site of injection.^{5,8} Moreover, in one study varying volumes of lignocaine were used.⁸

In our double blind randomised study, with all volunteers acting as their own controls, we have shown that warming lignocaine to 37°C resulted in a highly significant reduction in the pain associated with injection. Indeed, had a larger volume of lignocaine been injected (as in clinical practice), higher pain scores might have been recorded and better discrimination between injections achieved.

There are several possible reasons why the warmed lignocaine is less painful on injection. Greater pain may be due solely to greater nociceptor stimulation by the

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colder solution. Warming lignocaine may reduce the latent period as a consequence of temperature related changes in the pKa of lignocaine,⁹ resulting in a faster onset of neuronal blockade, inhibiting impulse conduction before the noxious stimulus is fully appreciated.

A similar theory has been proposed for the reduction in the pain of injection after the alkalisation of local anaesthetic solutions.¹⁰ Indeed, it has been suggested that bicarbonate may be added to reduce the discomfort associated with injection of local anaesthetic agents.¹¹ However, unlike the relatively simple process of warming, this entails mixing the two solutions, resulting in a reduction of solubility and possibly a reduction in stability.¹²

Although the technique of warming lignocaine to 37°C before injection has been adopted by dental practitioners, it has unfortunately not received widespread acceptance by the medical profession. We strongly recommend that all practitioners should adopt this technique to minimise patients' discomfort.

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Purging with paracetamol: report of four cases

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The drive to lose weight is paramount in patients with eating disorders and overrides any concerns about the damaging physical consequences that may ensue. The commonest methods used to control weight are vomiting and abuse of laxatives; the dangers of these methods have been well documented. Often medication is abused in the pursuit of weight loss: insulin may be omitted¹ and metabolic stimulants such as thyroxine² taken in large quantities. We describe titrated self poisoning with paracetamol in order to induce nausea and vomiting.

Case reports

Case 1—A 22 year old traffic warden with bulimia nervosa (body mass index 30.1 (weight in kilograms divided by square of height in metres)) as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* (DSM III-R) gave a history of habitually taking between 10 and 20 tablets of paracetamol on a weekly basis to induce vomiting after large binges. She described taking the tablets before going to bed and awakening about six hours later with severe nausea followed by vomiting.

Case 2—A 19 year old secretary fulfilled DSM-III-R criteria for bulimia nervosa (body mass index 21.3). She reported taking around 30 tablets of paracetamol at least once a week, which led to immediate vomiting. She described taking paracetamol as the most reliable method of inducing vomiting known to her and one that she reserved for unusually large binges.

Case 3—An 18 year old cleaner (body mass index 19.5) had excessive weight concerns but no objective binges. When feeling very overweight, which she estimated was once every two weeks, she took eight tablets of paracetamol to induce vomiting. This also stopped her eating as she then felt nauseous and generally unwell.

Case 4—A 21 year old hospital orderly met DSM-III-R criteria for bulimia nervosa (body mass index 19.2). She abused paracetamol fortnightly taking up to

14 tablets. Vomiting occurred three to four hours later. She valued the associated symptoms of nausea and anorexia as they reduced the likelihood of her bingeing next day.

Comment

These cases highlight a previously unreported form of paracetamol abuse—persistent titrated self poisoning. Deliberate self harm with paracetamol is common and produces a range of toxic effects which lead to at least 100 deaths a year in the United Kingdom.³

Our first two patients discovered the emetic properties of paracetamol after an overdose, but none of the patients presented acutely with paracetamol poisoning. In case 2 subsequent use of paracetamol produced vomiting immediately after ingestion. This may have been due to a conditioned taste aversion to paracetamol after the earlier overdose as appreciable absorption was unlikely. In the other cases vomiting occurred later, possibly due to acute gastric irritation, which produces vomiting within a few hours of overdosage.⁴ In serious self poisoning vomiting as a result of hepatotoxicity can occur up to 24 hours later.⁴

Paracetamol is excreted largely as its conjugate, glucuronide and sulphate. In chronic use glucuronidation dominates, proportional to the dose of paracetamol. This adaptive mechanism allows efficient metabolism of chronic doses of up to 12 g/24 h⁵ and may account for the apparent lack of serious medical consequences despite the potentially lethal doses used. Cognitive behavioural treatment of the eating disorder, supplemented with information about the medical consequences of paracetamol abuse and behavioural goals to limit consumption, proved successful in modifying this self poisoning behaviour in these patients. We suggest that patients with an eating disorder should be questioned about analgesic abuse during their initial assessment.

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