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Postoperative dental pain — a comparative study of anti-inflammatory and analgesic agents

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SUMMARY

Intravenous dexamethasone and diclofenac were evaluated in a double blind randomised trial, relative to an opioid (pentazocine) and placebo (saline), in 160 patients undergoing extraction of impacted lower third molar teeth. Test drugs were administered intravenously before surgery to provide postoperative analgesia. Following the operation, pain was assessed using a 10 cm visual analogue scale.

Patients who received diclofenac reported significantly less pain than others 30 minutes after surgery ($p < 0{\cdot}05$). Pain scores on the day following surgery were also significantly lower in the diclofenac group compared to the opioid and placebo groups ($p < 0{\cdot}05$) but not less than those who received dexamethasone — possibly indicating a long term advantage of the anti-inflammatory drugs. Vomiting was a problem in the opioid group.

INTRODUCTION

In an attempt to reduce the discomfort following oral surgery, steroids have been used by some oral surgeons.[1] Non-steroidal anti-inflammatory drugs have been shown to be effective in managing postoperative dental pain and are used widely for this purpose.[2] This study was aimed at determining the efficacy of anti-inflammatory agents, both steroidal and non-steroidal, in managing the pain following oral surgery. Since these agents are more effective when given before tissue disruption, they were administered intravenously, approximately 10 minutes prior to surgery.[3]

METHODS

One hundred and sixty fit (American Society of Anesthesiologists Grade I) patients admitted for extraction of two mandibular wisdom teeth under general anaesthesia were studied. The subjects were aged between 16 and 65 years and gave informed verbal consent. Approval for the study was granted by the Research Ethical Committee, The Queen's University of Belfast.

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All subjects were premedicated with 10 mg oral diazepam and randomly assigned to receive one of the following on a double blind basis — normal saline, pentazocine 0·4 mg/kg (30 mg maximum), dexamethasone 0·15 mg/kg (12 mg maximum) or diclofenac 1 mg/kg. Each test agent was within a coded 3 ml vial and diluted to 20 ml prior to intravenous injection. Induction of anesthesia was with propofol 2 mg/kg and muscle relaxants to facilitate tracheal intubation. Maintenance of anaesthesia was with nitrous oxide and halothane in 40% oxygen.

Co-codaprin (dispersible aspirin and codeine) tablets and levorphanol for intramuscular injection were available postoperatively as deemed necessary by the nursing staff in the recovery ward. Co-codaprin was also available to all subjects on a "4-hourly as required" basis.

Postoperative pain was assessed using a 10 cm visual analogue scale by staff trained in its use. The first pain assessment was carried out 30 minutes postoperatively by one of two recovery ward nurses prior to patients receiving any postoperative analgesia. A further assessment of pain was carried out by one of two dental housesurgeons on the morning following surgery. Analgesic requirements and postoperative vomiting were also recorded. On completion of surgery the operator rated surgical difficulty as simple elevation without bone removal, simple elevation after minimal bone removal, wide bone removal or tooth section, or wide bone removal and tooth section.

Comparability of the groups was assessed using one-way analysis of variance or Chi squared tests as appropriate. The visual analogue score results were also compared using analysis of variance after arcsin transformation to produce a parametric distribution. The 5% level of significance was used throughout.

RESULTS

All groups were comparable with respect to age, sex, weight, duration of operation and surgical difficulty. Visual analogue pain scores 30 minutes after completion of surgery indicated that the diclofenac group suffered less pain ($p < 0·05$) than all other groups (Table).

In those patients (29–33 in each group) who stayed overnight, pain scores were lower in the dexamethasone and diclofenac groups ($p < 0·05$). The opioid requirements postoperatively were not significantly different between groups. Many of the patients in the diclofenac group did not require any form of postoperative analgesia, which was significantly less than for the placebo or dexamethasone groups ($p = 0·03$). The incidence of vomiting was significantly higher in the pentazocine group relative to the others ($p < 0·01$).

DISCUSSION

Acute pain following body surface surgery is accentuated by various substances, such as bradykinin and prostaglandins, released during tissue damage. Bradykinin is considered to sensitise nociceptors and this activity is accelerated by the presence of prostaglandins.[4,5] The non-steroidal anti-inflammatory drugs inhibit this activity and reduce pain intensity, sometimes to the extent of providing better analgesia than opioids,[6] which we have confirmed in this study.

TABLE

	saline	*pentazocine*	*dexamethasone*	*diclofenac*
Characteristics of the four groups (mean ± SD)				
Surgical difficulty				
— grade (1)	2	1	2	1
(2)	23	19	18	18
(3)	11	15	17	16
(4)	4	5	3	5
Age: yr	24·3± 6·4	25·6± 6·7	23·8± 5·1	24·9± 6·8
Sex: M : F	18 : 22	20 : 20	17 : 23	21 : 19
Weight: kg	65·8±11·3	65·5±10·9	64·9±13·1	66·5±12·3
Duration of operation: min	36·9±11·7	38·1±10·9	38·9±12·9	37·5±11·5
Postoperative pain intensity (visual analogue scale: mean (lower and upper quartile)				
At 30 minutes	53 (33, 75)	56 (44, 74)	55 (44, 78)	28 (22, 47)
n	40	40	40	40
At day 1	17 (9, 38)	23 (18, 36)	13 (9, 20)	11 (4, 19)
n	31	33	29	33
Analgesic usage postoperatively				
Nil	5	9	5	13
Co-codaprin	29	25	27	24
Levorphanol	6	6	8	3
Vomited	3	16	6	3

Dexamethasone is an extremely potent anti-inflammatory steroid but the tissues must be relatively intact, as it is almost inactive in the cell-free prostaglandin synthetase system.[7] Tissue swelling is markedly reduced when dexamethasone is administered in adequate doses (10–20 mg iv),[1, 8] although the postoperative analgesia achieved in one of these studies may in part be due to competitive inhibition of a common metabolic pathway in the liver for steroids and opioids.[8]

Although contraindicated in various disease states, both non-steroidal anti-inflammatory agents and systemic steroids are considered valuable in the management of postoperative swelling, trismus and pain.[2, 9] The intravenous use of all test drugs just prior to surgery permitted high tissue levels to be achieved at an optimum time in this study. The manufacturers of diclofenac do not recommend intravenous use of their intramuscular preparation, due to an inadequate body of knowledge regarding this route (personal communication) but the drug has been successfully used intravenously in various clinical situations.[10, 11] The intramuscular preparation of diclofenac contains the solvent

1,2 propylene gycol which is probably responsible for the high incidence of venous thrombosis.[12] A dilution of the drug by at least fivefold greatly diminishes this problem, hence the dilutions used for all test drugs.

Pentazocine has been used satisfactorily for many years in the management of postoperative dental pain in this hospital. When the study commenced it was not a controlled drug, therefore avoiding legal technicalities in coding an opioid analgesic.

Nausea and dizziness may follow opioid administration[13] and in this study the incidence of vomiting was particularly high in the pentazocine group (vomiting is a definite end point so it alone was observed — not the combination of nausea and vomiting). The other active test drugs are considered to work at a peripheral level and sickness was not a problem. Only two measures of pain were carried out since supplementary analgesia is required by most individuals shortly after they waken following this type of surgery. A pilot study indicated that the first measure of pain is best made 30 minutes postoperatively as analgesics are given to most individuals after this period. Further measures are of little value until the following day, when all subjects are in a similar situation regarding analgesic use. Although coagulation disturbances can occur following the use of aspirin-like drugs, this was not observed in any case.

We conclude that both dexamethasone and diclofenac are capable of reducing postoperative discomfort on the day following oral surgery. Although dexamethasone is a potent steroid and capable of reducing oedema, it does not provide significant analgesia in the immediate postoperative period in the dose and manner used in this study.

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