Local anaesthesia for major general surgical procedures

A review of 116 cases over 12 years

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Summary

Between 1980 and 1992, 116 patients had either a simple mastectomy (32) or intra-abdominal procedures (84) under local anaesthesia (0.5–1% lignocaine with 1:200 000 adrenaline). A wide variety of general surgical procedures were feasible using only supplementary intravenous sedation (54%). Complications were uncommon and related to surgical procedure (three incorrect diagnoses, three procedures impossible) rather than the anaesthetic technique. There were no anaesthetic toxicity or postoperative problems. Local anaesthesia is extremely safe and facilitates larger surgical procedures than is generally appreciated.

Keywords: anaesthetic techniques, local anaesthesia, general surgery

Over recent decades there have been significant advances in general anaesthesia but surgery in the elderly and in patients with significant medical problems still has an attendant morbidity and mortality. Local anaesthesia has been steadily refined since its' introduction by Koller in 1884¹ and is now widely used in a number of surgical specialities, particularly ophthalmology. In general and orthopaedic surgery, whilst a limited number of operations (such as hernia repair) are frequently performed under local anaesthesia, this procedure is not widespread. A number of authors have described the use of local anaesthesia for more major procedures^{2–4} but in general these techniques were employed of necessity rather than choice. This is particularly so for intra-abdominal procedures. This review presents the operations that have been performed by four enthusiasts over a 12-year period. The aim is to highlight the potential of local anaesthesia by demonstrating the range of procedures that can be safely undertaken, the techniques involved and the possible complications.

Patients and methods

The study consists of a case review of all patients operated on under local anaesthesia (not regional) by four surgeons (AD, JP, DK and WEGT) between 1980 and 1992. Inform-

ation was collated from medical notes, anaesthetic records and operation notes. Cases in which local anaesthesia was augmented by regional or intravenous techniques were excluded from the study. Patients were not included if they had neck/head or limb surgery, abdominal hernia repair, simple drainage of intra-abdominal abscess or any minor procedures including peritoneo-venous shunts, laparoscopic or endoscopic procedures.

The 116 patients presented in the study are those who had intra-abdominal surgery (84; 53 women, 31 men) or simple mastectomy (32). The median age was 74 years (range 27–92) and all the patients were grade III or worse on the American Society of Anaesthesiologists (ASA) classification of illness (box 1).

The decision that a procedure would be best performed under local anaesthesia was always made jointly between the senior surgeon and anaesthetist based on individual clinical grounds. The absolute requirement was full consent and co-operation of the patient and was obtained after full discussion in all cases. The anaesthetist was always present in theatre to monitor the patient and in case sedation or general anaesthesia was required. The ASA standards for basic intra-operative monitoring were observed in all cases with more intensive monitoring at the anaesthetist's discretion with regard to the procedure and the patients' pre-morbid condition.

Local anaesthetic technique

Premedication with 2 mg of oral lorazepam was used in many of the earlier patients but was

ASA classification of illness

- Grade I: A fit and healthy patient
- Grade II: A patient with mild systemic illness
- Grade III: A patient with severe systemic illness that is not incapacitating
- Grade IV: A patient with an incapacitating illness that is a constant threat to life
- Grade V: A moribund patient who is not expected to live for more than 24 hours, with or without surgery

Box 1

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abandoned because it was felt this disinhibited elderly patients. Any supplementary sedation was given by the anaesthetist who calculated the maximal dose of local anaesthetic, usually lignocaine 0.5 or 1% with 1:200 000 adrenaline. Occasionally prilocaine (also with adrenaline) or bupivocaine were used when a larger volume than usual was needed or the prolonged action of bupivocaine was felt likely to be of benefit postoperatively. In all cases the surgeon's aim was to perform the procedure using the minimum amount of local anaesthetic required to give adequate anaesthesia.

All planned incisions were marked with Bonneys blue and anaesthetic was infiltrated beneath the marked area, specifically and then diffusely into deeper fascial layers. Our previously described technique for mastectomy has not changed.⁴ Skin infiltration was occasionally supplemented by a little infiltration into the pectoralis major fascia. In abdominal cases the skin infiltration was augmented by infiltration of the extraperitoneal space when reached. As a general rule in intra-abdominal procedures, an attempt was made not to exceed 50% of available anaesthetic into the peritoneal cavity.

As the only sensation appreciated by visceral peritoneum is stretch, both cutting and the use of diathermy are painless. Any remaining local anaesthetic was saved for infiltration across the mesentery of bowel to be resected but it was found that with gentle handling of the bowel and avoidance of stretch, the intraperitoneal part of the procedure could be performed with no additional anaesthesia.

MAXIMUM DOSE CALCULATION
While recommended maximum doses of local anaesthetics offer a useful guide (table 1), the current manufacturer's recommendations are by necessity over cautious and not fully justified on a scientific basis.⁵ As the risk of toxic side effects on the central nervous system and cardiovascular system (box 2) is directly related to blood concentrations, great care was taken to

prevent direct intravenous injection or injection into inflamed tissue (box 2).

The choice of local anaesthetic was left to the surgeon performing the operation as there were differing indications for each agent (table 2). The addition of adrenaline reduced the amount of local anaesthetic reaching the circulation by decreasing the uptake from the injection site, thereby giving the local anaesthetic a greater effect and longer duration of action. Following

Local anaesthesia: dose calculation

Wt/volume measurements are given as g/dl (ie, 1% = 1 g/100 ml of solvent)

Hence,

$$\text{Volume allowable (ml)} = \frac{(\text{safe dose [mg/kg]} \times (\text{patient's weight[kg]}))}{10 \times (\text{wt/vol percentage[g/dl]})}$$

NB Adrenaline maximum dose = 500 µg = 100 ml at 1:200 000 concentration

Box 2

Basic monitoring standards of the ASA

- *Standard 1:* Qualified anaesthesia personnel shall be present in the room throughout the conduct of all general anaesthetics, regional anaesthetics and monitored anaesthesia care
- *Standard 2:* During all anaesthetics, the patient's oxygenation, ventilation, circulation and temperature shall be continually evaluated.

Box 3

Basic monitoring required during local anaesthesia

- oxygenation: pulse oximetry, adequate illumination, observe/auscultate ventilation
- circulation: ECG continuously displayed, blood pressure and heart rate every 5 mins
- temperature: ready available means to continuously monitor temperature

Box 4

Local anaesthesia: toxic effects

- CNS: circumoral tingling → nervousness/ excitability → convulsions → coma → respiratory arrest
- CVS: depressed myocardial excitability, contractility and conductivity → hypotension and decreased pulse rate → cardiac arrest
- respiratory: bronchospasm due to hypersensitivity reaction, methaemoglobinaemia with prilocaine
- local: ischaemic tissue necrosis due to adrenaline

Box 5

Table 1 Toxicity data and potency of local anaesthetic agents (adapted from Reynolds)⁶

	<i>Bupivocaine</i>	<i>Lignocaine</i>	<i>Prilocaine</i>
Max. safe dose, plain (mg/kg)	2–3.5	3–4.5	6
Max. safe dose (mg/kg), with adrenaline 1:200 000	2–3.5	7	6–8*
Relative potency	3–4	1	1

*Limited due to methaemoglobin formation

Table 2 Indications for use of particular agent

	<i>Bupivocaine</i>	<i>Lignocaine</i>	<i>Prilocaine</i>
Advantages	longest action most potent	rapid onset largest volume (with adrenaline) for infiltration	low toxicity largest volume (without adrenaline) for infiltration
Disadvantages	least volume for infiltration	least potent	least potent

inadvertent intravascular injection, the tachycardia from adrenaline also gives warning of pending complications, constant monitoring being essential (boxes 3 and 4).

Blood levels of local anaesthetic were not measured as toxicity from normal, slow absorption of correctly placed local anaesthetics (box 5) in a submaximum dose has not been shown to be a problem.⁶

Results

Adequate anaesthesia was produced in all patients and allowed the performance of the surgery without significant deviations from the usual technique. No patient had to be converted to a general anaesthetic. There was no local anaesthetic toxicity encountered and no patient had any immediate postoperative problems related to the technique. Surgical morbidity in terms of skin haematoma, skin necrosis, discomfort, or an increase in the wound infection rate was absent.

Local anaesthetic dosage did not exceed 80% of the maximum recommended dose in any patient. However, 62 patients (54%) were given additional intravenous sedation but then only in small doses (2.5–5 mg diazepam), to prevent disinhibition that can occur with larger doses.

The operations performed are shown in table 3. No procedure was possible in three elderly patients with extensive mesenteric ischaemia but this was anticipated and the laparotomy was essentially diagnostic, removing the need for a general anaesthetic in very ill, hypotensive patients. Incorrect pre-operative diagnoses were made in three patients, however the use of a local anaesthetic did not preclude the correct operation (caecostomy for pseudo-obstruction, enterostomy for widespread intraperitoneal malignancy, and reduction of lateral space hernia).

Of the six patients who had large bowel resections, five had supplemental infiltration of the mesentery. Sigmoid colectomy for volvulus was successfully performed in three patients, one who had already had a bowel preparation,

Table 3 Procedures performed (n = 116)

Procedure	Number	Age group (years)
Mastectomy	32	49–89
Appendicectomy	11	34–89
Cholecystotomy	11	62–81
Stoma formation	16	66–83
Perforated peptic ulcer	8	34–92
Closure of stoma	12	62–85
Laparotomy dehiscence repair	4	59–77
Gastroenterostomy	4	69–80
Laparotomy for mesenteric ischaemia	3	61–73
Bleeding duodenal ulcer	2	43–71
Large bowel resection	6	73–88
Adhesionolysis	2	41–67
Enterostomy	1	27
Internal hernia and bowel resection	3	57–79
Detorsion sigmoid	1	76

had an end-to-end anastomosis, the other two had Paul–Mikulicz colostomies. The other three large bowel resections were limited resections of caecal carcinoma, ischaemic bowel, and leaking anastomosis line.

Discussion

The operations described here indicate the type of procedure that, with the help of the anaesthetist, can be performed under local anaesthesia and demonstrate the very low associated morbidity and mortality. The choice of patients and the indications for the use of local anaesthetic tended to be relative rather than absolute and decided in consultation with the anaesthetist. In younger patients problems were often more specific but in the elderly patients, familiarity with the effectiveness of this method gradually altered our approach so that we used it out of choice rather than due to lack of choice.

We have previously described the advantage of performing simple mastectomy under local anaesthesia and we have continued to use this method. It is extremely valuable in elderly patients whose tumours have escaped tamoxifen control (or who are unlikely to comply with treatment) or in those patients whose lesions are large or unpleasant at initial presentation.

A total of 84 patients had intra-abdominal procedures for a wide range of pathology and in none did the use of local anaesthesia prevent the correct operation being performed. A case in point was a patient with a perforated duodenal ulcer and a low-lying liver, displaced below the incision by emphysema. More local anaesthetic was infused to extend the incision and gentle retraction successfully employed.

In our experience, there are few absolute contraindication to local anaesthesia: patient refusal or non-compliance being the most significant. Obesity requires more anaesthetic (but usually still less than 80% of the maximal dose)

Summary of results

- conversion to general anaesthetic not required but approximately half required supplemental sedation
- <80% of maximum dose of local anaesthetic used with no toxic side-effects
- local side-effects comparable to general
- obesity no contraindication

Box 6

Local anaesthesia: key points

- wide range of major surgical procedures feasible
- requires close co-operation with and monitoring by anaesthetist
- patient compliance and understanding essential
- awareness of potential of local anaesthesia widens treatment options

Box 7

and is technically more difficult but is still feasible. The presence of an anaesthetist is essential for assistance in monitoring the patient and administering additional sedation. This will obviously also allow the use of general anaesthetic if the need arises. The usually quoted reasons for why local anaesthetic is under used (Britain performs less procedures under local anaesthetic than Scandinavia, the USA or the Third World^{5,6}) are fear of failure, the time taken for induction, the fear of neurological complications and the unpopularity of having an awake patient.⁷ Clearly these objections can all be overcome by co-operation

between anaesthetist, surgeon and patient in a careful standardised approach.

Much damage was done by WR Stone in 1901⁸ when he wrote "The presence of an anaesthetist and his expertise can be dispensed with if cocaine be employed". We believe that surgeons and anaesthetists should adopt a more positive approach to local anaesthesia. Our experience has demonstrated that many major operations are technically possible under local anaesthesia which facilitates a far wider range of surgical procedures than is generally appreciated.

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