POSTOPERATIVE ANALGESIA : A LOCAL SOLUTION

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ABSTRACT

A simple, safe, and effective technique of postop analgesia using wound perfusion with bupivacaine 0.25% via an indwelling intracatheter inserted in the depth of the wound was carried out on 25 ASA grade I/II patients of varying age groups reporting for a variety of surgical procedures. The first dose was given prior to shifting the patient from the OT. Subsequent doses were administered on patient demand basis. The intracatheter was kept in position for 48-72 hours postop. An analysis was made on the patients' pain relief using a visual analogue scale, dose/frequency of bupivacaine required, dose/type of supplemental analgesia needed, haemodynamic changes during infiltration, wound healing, and patient satisfaction. In this study only 12% of patients required opioids on Day One postoperatively. There were no adverse effects of infiltration either systemically or on wound healing, and all the patients had excellent postop analgesia.

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KEY WORDS :Analgesia; Bupivacaine; Postoperative; VAS.

Introduction

There was an age in medical practice when the clinician concerned himself solely with diagnosis and treatment. The rendering of pain relief per se was of lower consequence. As medical practice and social attitudes have evolved, so has the role of the clinician in providing analgesia for acute pain [1]. Inadequately treated pain may result in cardiac dysrhythmias, hypertension, and myocardial ischaemia, with disastrous consequences. Postoperative pain is a unique pain situation in which pain itself is largely iatrogenic. The clinician is obliged in this circumstance to minimize the adverse effects of the pain from tissue trauma for which he is responsible [2].

Postoperative analgesia is conventionally controlled by the administration of opiates or their derivatives [3]. These potent centrally acting agents may produce respiratory and cardiovascular depression or may interact dangerously with other drugs such as MAO inhibitors. Regional anaesthetic techniques for the management of acute pain involve intermittent or continuous administration of local anaesthetic agents to interrupt sensory transmission. However, most nerve block techniques are not pain specific. Noxious as well as non-noxious stimuli are blocked alike; sympathetic activity and, more often than not, a certain amount of motor activity is blocked as well [3].

A possible alternative may be the direct perfusion of the surgical wound with local anaesthetic solution via an indwelling intracatheter inserted into the depth of the wound overlying the peritoneum or muscle

sheath depending on the nature of surgery [3-6]. The present study evaluated this method using 0.25% bupivacaine perfusion of wound area as an uncomplicated means to replace or reduce the need of centrally acting agents to very safe levels.

Material and Methods

The study comprised 25 patients in ASA grades I/II of different age groups reporting for a variety of surgeries. The patients were visited and the nature of anaesthesia, surgery, use of a visual analogue scale (VAS) and mode of postop analgesia to be employed was explained to them. An informed written consent was obtained from each patient.

Premedication : Standard regime as below :

- (a) Tablet/syrup diazepam (0.2 mg/kg) to a maximum of 10 mg at bedtime on the preoperative night.
- (b) Tablet/syrup diazepam (0.1 mg/kg) at 0600h on the morning of surgery.
- (c) Injection atropine (10µg/kg to a maximum of 0.6 mg IM) 30 minutes prior to induction
- (d) Injection pethidine (1mg/kg to a maximum of 50 mg IM) 30 minutes prior to induction.

Technique of Anaesthesia

After attaching all essential-monitoring devices, the patients were given either a general or a spinal anaesthetic depending on the nature and duration of the surgery.

(a) *General anaesthesia* : Induction was achieved by using Inj thiopentone. Intubation was with Inj succinylcholine (1.5 mg/kg to a maximum of 100 mg IV). Maintenance was with oxygen-nitrous oxide-halothane-pavulon-IV fluids essential monitoring. Reversal of neuromuscular blockade was with Inj neotigmine and Inj atropine.

(b) *Spinal anaesthesia* : 5% heavy xylocaine (1-1.5 mL) was instilled in L2/3 subarachnoid space using a 23 G disposable spinal needle. Bupivacaine injection was not used for spinal anaes-

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thetia, as it was not desirous to have a long duration postoperative block as it was felt that this might interfere with the postop analgesia scores.

Placement of Intracatheter :

A 16/18 gauge intracatheter was placed so that the tip of the intracatheter was overlying the peritoneum (eg. cholecystectomy) or the muscle sheath (eg. herniorrhaphy) under direct vision (Fig 1). The intracath was introduced by the operating surgeon prior to wound closure through a separate puncture in such a way as not to hamper patient comfort in the postoperative period. The intracatheter was anchored to the skin by two stay sutures and remained in situ until 48-72h postop (Fig 2).

Dose and Timing of infiltration of local Anaesthetic Solution :

After placement of the intracatheter, 2 mL of 0.25% bupivacaine solution/cm of incision length [7] was infiltrated prior to shifting the patient from the OT (Fig 2). This was given as a standard loading dose to all the patients despite the fact that they were still under the effects of anaesthesia. Thereafter, subsequent 'top up' doses of the same volume and concentration were given on a patient demand basis over the next 48-72h. Prior to each injection, careful aspiration was done to ensure the catheter tip was not in a blood vessel. Strict aseptic precautions were followed for all injections given through the intracatheter. If patients did not experience adequate analgesia after infiltration, they were offered parenteral pethidine on demand. Maximum dose of bupivacaine used was 2 mg/kg-body weight and there was a lock out interval of 4h between doses. Various parameters as noted below were stud-

Fig. 1 : Correct placement of catheter tip over muscle sheath

Fig. 2 : Intracatheter anchored with stay sutures ready for wound perfusion immediately post op.

ied.

Parameters Noted During Wound Perfusion :

(a) *Pain index* as measured by VAS before and after infiltration : the relief of pain was objectively assessed using a VAS once the patients were out of the effects of anaesthesia. The patients were asked to make a self-assessment of their pain experienced on a 10 cm scale, with a score of '0' representing no pain and a score of '10' representing the most severe pain ever experienced by the patient. VAS readings were noted before and after infiltration of bupivacaine and the time duration to produce analgesia was recorded.

(b) *Haemodynamic changes during infiltration* : close monitoring of the patients' pulse, blood pressure and oxygen saturation was done during wound perfusion.

(c) *Requirement of other analgesics* : if patients did not experience adequate analgesia, they were given Inj pethidine 1 mg/kg (maximum of 50 mg) intramuscularly on demand. After removal of the intracatheter, patients were given oral NSAIDs until the eighth postoperative day.

(d) *Wound healing* : a note was made as to whether the wound healed by primary intention or not.

(e) *Patient satisfaction* : prior to discharge, the patients were interviewed and their views on the adequacy of analgesia was noted.

Results

A total of 25 patients of both sexes in ASA grade I and II reporting for a variety of surgeries were studied over a 12 month period in a peripheral service hospital. The demographic and anaesthetic data are represented in Table 1. Males constituted 56% of the study group and 72% of the patients were in the age group of 16-45 years.

TABLE 1

Demographic and anaesthetic data

Parameter	No. of patients
Age (years)	
0-15	04
16-30	08
31-45	10
46-60	02
61-75	01
Sex	
Male	14
Female	11
ASA Grade	
I	19
II	06
Anaesthetic Technique	
General Anaesthesia	13
Spinal Anaesthesia	12
Anaesthesia/Operation Time (hours)	
0.5-1	15
1.0-1.5	05
1.5-2.0	05
Previous Anaesthetic/Operative Experience	
Nil	22
One or more	03

76% of the patients were in ASA grade I. There was no variation in anaesthetic technique employed in the study population. 80% of the operations were conducted in under 1½ hours. Only 12% of the patients had undergone any previous surgery.

TABLE 2
Surgical data and postoperative analgesic requirements

Operation	No. of cases	Mean incision length (cm)	Day of op/ postop day	Mean single dose of 0.25% bupivacaine soln (mL)	Freq of infiltration	VAS Before infiltration	VAS After infiltration	Req of other analgesics
Herniorrhaphy	06	7.5-10	D1	20	2x	6-8	0-1	NSAIDs
			D2	10-20	1-2x			from
			D3	Nil	Nil			D3-D8
Herniotomy	04	5	D1	10	2x	5-7	0-1	NSAIDs
			D2	10	1x			from
			D3	Nil	Nil			D3-D8
Incisional hernia repair	02	15-20	D1	30-40	2x	7-9	1-2	NSAIDs
			D2	30-40	2x			from
			D3	30-40	1x			D4-D8
Appendectomy	03	5-7.5	D1	10-15	2x	6-8	0-1	NSAIDs
			D2	10-15	2x			from
			D3	Nil	Nil			D3-D8
Cholecystectomy	04	7.5	D1	15	3x	7-9	1-2	NSAIDs
			D2	15	2x			from
			D3	15	1x			D4-D8
Pyelolithotomy	01	20	D1	40	3x	8-10	2-3	NSAIDs
			D2	40	2x			from
			D3	40	2x			D4-D8 (*)
Ureterolithotomy	01	15	D1	30	3x	7-9	1-2	NSAIDs
			D2	30	2x			from
			D3	30	2x			D4-D8
Laparotomy	02	20	D1	40	3x	7-9	1-2	NSAIDs
			D2	40	2x			from
			D3	40	2x			D4-D8 (*)
Breast lump excision	02	5	D1	10	2x	5-8	0-1	NSAIDs
			D2	10	1x			from
			D3	Nil	Nil			D3-D8

(*) Single dose of 50 mg pethidine IM given on D1

Surgical data and postop analgesic requirements are represented in Table 2. 40% of the surgeries conducted were herniorrhaphies and herniotomies. The average duration of postoperative hospital stay was from between 03 and 10 days. All wounds healed by primary intention with no incidence of any form of secondary wound infection.

Patients were given 0.25% bupivacaine infiltration in a dose of 2 mL/cm of incision length. Only 12% of the patients required a single 50 mg dose of pethidine which was administered on D1. The patients' subjective assessment of the severity of their pain as measured by VAS was between 5-10. After infiltration of 0.25% bupivacaine, they had VAS between 0 and 2. The time required for reduction of pain was 5-10 minutes after infiltration with bupivacaine with the duration for reduction of pain reducing with each dose of bupivacaine. The best results were noted in patients undergoing herniorrhaphy, herniotomy, and appendectomy. Furthermore, there was no incidence of postoperative urinary retention following infiltration with bupivacaine. Nor was there any hypoxia associated with injection as monitored by pulse oximeter.

The majority of patients (88%) had excellent to above average postoperative analgesia and were totally satisfied with the technique employed. Only 12% of patients felt analgesia could have been better (2 laparotomies and 1 pyelolithotomy).

Discussion

Progress in the relief of postoperative pain has been slow and unimpressive in comparison with the advances made in other areas of surgery and anaesthesia.

For many years the mainstay of therapy has been morphine or similar narcotic analgesics. Such agents lack specificity both in the site and the nature of their activity and the price of adequate relief of pain is often an unacceptable degree of central nervous system depression [3]. There is evidence that it is possible to overcome some of the objections to the use of opiates by varying the route and rate of administration and by tailoring the analgesic regimen to the individual patient. The most sophisticated technique involves the use of a computerized variable rate infusion pump.

Regional anaesthetic techniques have gained widespread acceptance as an additional method for the management of acute pain. This has largely been in the form of epidural, caudal, or nerve block methods. It appears, therefore, that there is a place for some uncomplicated form of a regional or local anaesthetic, which might replace centrally acting agents or facilitate reduction in their dosage to very safe levels [3].

Almost fifty years ago, a technique of inserting an indwelling catheter beneath the anterior rectus sheath for the purpose of continuous postoperative abdominal wound perfusion was described [4,8]. This method of controlling incisional pain was reported to have sig-

nificant advantages over continuous epidural analgesia for post-laparotomy pain in a comparative evaluation of the technique done later [1]. Perfusion of surgical wounds with local anaesthetic solution has been done for breast lump excision [5], upper abdominal surgeries [4], and inguinal herniorrhaphy [6]. Levack and associates also reported favourably on the perfusion of subcostal incisional drains with bupivacaine for analgesia following splenectomy and cholecystectomy and noted improvements in forced vital capacity and narcotic requirements [9]. Moss and his colleagues found that combining immediate duodenal feeding via nasogastric tube and infiltrating peritoneum, fascia, subcutis and skin with 40-50 ml of 0.5% bupivacaine in patients undergoing cholecystectomy, 93% of their patients could be discharged within 24h and 81% did not require any narcotic [10]. We have also given postop local infiltration for laparotomy, pyelolithotomy, and ureterolithotomy operations in this study.

Many different dosing regimens have been recommended [2,11]. for eg. Hashemi and Middleton infiltrated subcutaneous bupivacaine around the wound to provide postop analgesia in patients who had undergone herniorrhaphy [12]. However, in our study one reasonable schedule that we have found useful is to perform local wound infiltration with 0.25% bupivacaine in a dose of 2 ml solution for every cm of incision length via an indwelling intracatheter.

In this study VAS was used for assessment of subjective pain experienced by the patients. A fixed protocol was maintained and 0.25% bupivacaine was infiltrated as per the patients' demand. At no time were parenteral opioids with held, however only 12% of the patients in our study required a single dose on D1. The resultant large reduction in opioids administration allowed for early ambulation and decreased the incidence of nausea and vomiting following surgery [5]. A large bore intracatheter (16/18G) was used for infiltration and it was removed on D3 or D4 in all cases. All patients required 2-3 infiltrations on D1 and D2. On D3, most of the patients were put on oral NSAIDs. It is important to emphasize that in this study, the patients played a very active role in the delivery of their postop analgesia. Sutures were removed on the eighth postoperative day with all cases healing by primary intention.

Wound perfusion with special catheters like Redivac suction catheters with bacterial filters were employed by Thomas et al [3]. Special polyethylene tubes were put on rectus sheath by Gerwig et al [5] and by Blades and Ford [8] following upper abdomi-

nal operations. However, these techniques need more surgical attention and maintenance in comparison with the method of using a large bore intracath. This is readily available and of low cost (Rs.30/-) as compared to other implements.

During our pilot study, we have used perforated infant feeding tubes, epidural catheters and Romovac drainage tubes. However, the delivery of bupivacaine inside the wound was not satisfactory as the exact length of perforation had to be well inside the wound to prevent leakage of the drug. This required meticulous calculation and frequently resulted in wastage of catheters. Additionally, perforation reduced the ability to efficiently deliver the required volume of drug at the required pressure to adequately bathe the wound surface. We found that a large bore intracatheter overcame these problems as it was easily and rapidly placed and anchored (Figs. 1,2). However, it was also observed that a non-perforated infant feeding tube could deliver the local anaesthetic solution through a POP casing into the operated wound very effectively.

In case where a separate drainage tube was used, (eg. pyelolithotomy and ureterolithotomy), the intracath was selectively positioned at a separate level so that the delivered medicine was not drained out. Also, where large incisions were made, (eg. Laparotomy), we had used two intracaths, one at the top half of the wound, and the other at the bottom half diagonal opposite to each other to ensure the complete wound area was irrigated by bupivacaine solution evenly. It is important to note that the drug is delivered to the patient in the supine position to prevent gravitation of the solution, which may lead to incomplete analgesia. In addition, when more than one wound incision / puncture site is present, a separate intracath can be used to infiltrate each site.

We kept a maximum top up dose of bupivacaine to be used as 2mg/kg-body weight. If a larger volume is required to cater for multiple incisions, the dosage of bupivacaine can be reduced to 0.125%. We did not use adrenaline to prolong the duration of analgesia in our infiltrations for fear of hampering blood supply to the wound, which may have interfered with the healing process.

Our study has shown that this regimen given on a patient demand basis is a safe and very effective means of analgesia even in major surgeries such as cholecystectomy, laparotomy as well as pyelolithotomy. We found the best results with herniorrhaphy/herniotomy (comparable with epidural analgesia) which were most likely due to the superficial po-

sition of the iliohypogastric and ilioinguinal nerves. Appendectomy and breast lump excision also had excellent results.

Literature has shown variable results with local wound infiltration. One interesting finding was that in certain cases instillation of physiological saline itself was found to produce effective analgesia. This may represent a true therapeutic effect attributable to the removal or dilution of pain mediating substances such as histamine or vasoactive peptides [2,3]. Bupivacaine infiltration, in addition to its long acting local anaesthetic effect, also probably acts in a similar fashion. This may explain the progressively reduced dosages required during the subsequent postop days, the wound is continuously bathed in this solution. Studies have shown that the maximum postoperative pain occurs between the twelfth and thirty sixth postoperative hours [4]. Tverskoy et al assessed the severity of constant incisional pain, movement associated with incisional pain and pain upon pressure applied to the surgical wound using an algometer with a visual analogue self rating method at 24h, 48h and 10 days after surgery. The addition of local anaesthesia significantly decreased the intensity of all types of postoperative pain. This effect was especially evident with constant incisional pain that disappeared almost completely 24h after surgery. With pain caused by pressure on the site of the surgical incision the pain score difference between general plus local anaesthesia was obvious even ten days after the surgery [6].

The drawbacks of this technique, however, are that it assumes that a significant amount of the patient's pain is due to wound pain arising from the superficial plane of dissection. It does not address the issue of pain arising from other potentially deeper or remote structures. This has been experienced during management of postop cholecystectomy and pyelolithotomy operations. Also, local pain relief cannot cater for pain due to other invasions such as the IV line, urinary catheter or Ryle's tube. For this reduced doses of narcotics or sedatives may be supplemented. Additionally, it is a problem in installing the catheter where a continuous drainage is required as that might lead to drainage of the local anaesthetic solution from the wound site. Another drawback is that it may be risky to use this procedure in neck surgery (eg. thyroid surgery) for the possible danger of motor blockade of the laryngeal nerves.

To summarize, the methodology of direct anaesthetic perfusion of a surgical wound is elementary with no complications related to toxicity, hypersensitivity, infection or impaired wound healing [3]. It is

low in cost and does not require any technical expertise, either in terms of catheter placement or in administration of top up doses. It greatly reduces narcotic requirements and is an asset in severely compromised patients (eg. hypovolaemic shock) where other forms of analgesia may be contraindicated. At the same time, wound infiltration with bupivacaine is in effect a form of low cost patient controlled analgesia where the patient can safely tailor his analgesic requirements. This technique is most suitable for herniorrhaphy, herniotomy, appendectomy, and breast lump excisions. It may be employed as a useful adjunct in major surgeries to reduce the requirement of narcotic analgesics. It will not be incorrect to state that exclusion of this technique from patient care may be a regrettable decision as its simplicity and utility offers widespread applications. We plan to implement the same in our already existing armamentarium of analgesic options.

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