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**EXTRAPLEURAL VERSUS**

**EPIDURAL CATHETER TECHNIQUES**

**EMPLOYING ROPIVACAINE ANALGESIA FOR**

**POST-THORACOTOMY PAIN RELIEF**

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**Abstract**

*Objective: To assess the effectiveness of the long acting local anesthetic*

*(0.25% ropivacaine) intermittently administered through an extrapleural*

*paravertebral catheter versus a thoracic epidural catheter on postthoracotomy*

*pain relief*

*Patients and Methods: Forty patients undergoing elective posterolateral*

*thoracotomy during the period between July 2001 and August 2002*

*were prospectively studied.* They *were* randomly *allocated into two*

*groUps (A and B) of 20 patients each. Group A patients received an epidural-*

*type catheter inserted by* the *surgeon into art extrapleural pocket extending*

*for* 2 *to 3 intercostal spaces both above and below the thoracotomy*

*incision alongside the vertebral column by the conclusion of operation.*

*A bolus dose of 15 ml of 0.25% ropivacaine analgesia was given during*

*chest closure. Group B patients received a thoracic epidural catheter inserted*

*by the anesthesiologist at T5-6 or T6-7 interspace before induction*

*of anesthesia. A bolus dose of 15 ml of 0.25% ropivacaine analgesia Was*

*given after confirming the correct position of the epidural catheter. Postoperatively,*

*patients in both groups were intermittently administered 25 ml*

*of 0.25% ropivacaine analgesia at 6 hourly intervals for 3 successive*

*days. Pain scores (verbal rating scale), requirement of additional analgesia*

*(P/SAID), pulmonary function test, shoulder range of motion as well as*

*any complication encountered were assessed* and *compared in both*

*groups.*

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*Results: Excluding the immediate postoperative arousal period, the extrapleural*

*analgesia provided better pain control than the thoracic epidural*

*analgesia in the form of less mean values of the verbal rating scale*

*(VRS). Also, the extrapleural analgesia provided more rapid improvement*

*of pulmonary functions, progressive increase of the shoulder range of motion*

*(SROM) as well as less analgesic requirements in comparison to the*

*thoracic epidural analgesia. However these differences were statistically*

*non-significant (P>0.05). Side effects namely, hypotension, bradycardia*

and *atelectasis were troublesome only in the thoracic epidural analgesia*

group. *There was no mortality in either group.*

*Conclusion: Extrapleural paravertebral* catheter *technique is* a *valuable*

*alternative to the thoracic epidural technique for post-thoracotomy*

*pain relief It is easy to perform by the surgeon at the conclusion of operation*

*without complications or side effects. It should be considered as the*

*first choice alternative for post-thoracotomy pain control.*

**Introduction**

Patients undergoing thoracotomy

experience severe and intense

pain as a consequence of

tissue damage to the ribs, muscles,

and peripheral nerves

that alter chest wall mechanics

(Richardson et al 1999). Ineffective

chest expansion may predispose

to atelectasis, ventilation

/ perfusion mismatching, hypoxemia,

and infection (Kruger and

Mc Rae 1999). Effective clearing

of secretions with cough and

early mobilization can lead to

quicker recovery and shorter

length of hospital stay (Soto and

Fu, 2003).

Various treatment modalities

have been introduced for the management

of post-thoracotomy

pain. These include epidural analgesia,

intercostal nerve blockade,

cryoanalgesia, systemic use of opioids

or nonsteroidal antiinflammatory

drugs, and subara.chnoid optold

administration (Tetik et al,

2004). Systemic administration of

narcotics or nonsteroidal antlinflammatory

drugs, either alone or

in combination, often do not result

in satisfactory pain relief.

Furthermore, serious adverse effects

may occur at higher doses.

The modem strategies therefore

aim at improving pain relief by se-

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lective administration of drugs to

the pain-causing anatomic region

rather than by the systemic route

(Kavanagh et al.,1994).

of 15 ml will spread over and

block at least 3 dermatomes (Richardson

and Lonnqvist 1998).

Intercostal nerve blocks can be

performed either intraoperatively

- or postoperatively. They provide

good pain relief lasting for 6 to 12

hours ,however the uncomfortable

status of the patients because of

serial injections and long-term intercostal

neuralgia have been reported

as disadvantages of this

technique (Peetters-Asdourian and

Gupta 1999) and (Dryden et al

1993). Sabanathan and associates,

1988 have initiated the

technique of extrapleural intercostal

nerve block that allows the

thoracic surgeon to placeme a

catheter into an extrapleural

pocket at the conclusion of operation.

This indwelling extrapleural

catheter allows frequent dosing or

continous infusions of local anesthetic

agents and avoids multiple

needle injections (Soto and Fu,

2003). No reliable formula has yet

been developed to define the dose

of local anaesthetic required for

paravertebral intercostal blockage,

however many investigators assumed

in an adult that a volume

Ropivacaine is a new long acting

amide local anesthetic available

as a pure S-enantiomer closely

related in structure to Bupivcaine

and Mepivacaine (Behnke et al.

2002). Several Studies have demonstrated

that ropivacaine has a

lower CNS and cardiotoxic potential

than bupivacaine and is suitable

for epidural anesthesia (Behnke

et al. 2002) and (Lemay et al,

2003). Lemay and associates,

2003 reported successful use of a

single large bolus dose of 10 ml

ropivacaine 0.75% for thoracic

paravertebral analgesia during minor

breast cancer surgery without

systemic complications. They concluded

that the Maximal ropivacaine

plasma concentrations re- •

suiting from paravertebral blockade

are similar to those reported

with equivalent dbses of bupivacattle

(Lemay et al, 2003). The

present study was designed to assess

the analgesic effect of 0.25%

ropivacaine on post-thoracotomy

pain when intermittently administered

through an extrapleural paravertebral

catheter versus a tho-

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racic epidural catheter.

**Patients and Methods**

During the period between July

2001 and August 2002, forty consecutive

patients undergoing elective

posterolateral thoracotomy

were prospectively studied. Patients

unable to co-operate, those

with infection at the proposed site

of epidural catheter placement,

patients who had FEV1 of less

than 60% from the reference value

and those with preoperative abnormal

shoulder range of motion

were excluded from the study.

Two randomized groups of 20 patients

each were compared regarding

the intensity of postthoracotomy

pain, recovery of ventilatory

functions, shoulder range

of motion as well as any other

complication encountered.

Anesthetic technique: One

day before operation. the use of

the hand-held spirometer was explained

to the patients and the

preoperative baseline ventilatory

functions were obtained. The

Prince Henry pain scale (Table 1)

was also explained. One hour preoperatively,

all patients were premedicated

with 0.5 mg atropine

IM, 2mg midazolam and 100 mcg

fentanyl. Before induction of anesthesia,

application of standard

clinical monitors were done (electrocardiographic

leads, automated

blood pressure cuff, pulse oximeter

and capnography). Anesthetic

induction was done by 5mg/kg

thiopental and double lumen endotracheal

intubation was facilitated

by 1 mg/kg succinylcholine.

Anesthesia was maintained with

Vecronium 0.1 mg/kg and isoflurane

(0.6-0.1% inspiratory) in

100% oxygen. The lungs were ventilated

with continuous positive

pressure ventilation to maintain

normocapnea. No additional opiolds

were allowed. At the end of

operation, neuromuscular blockade

was antagonized by using

0.04 mg/kg neostigmine with 0.01

mg/kg atropine IV.

Epidural catheter technique:

Before induction of general anaesthesia,

group B patients received

an epidural catheter placed

at a thoracic level between T5-6 or

T6-7. With the patient in sitting

position the catheter was introduced

by using the paramedian

approach and loss of resistance

technique and the catheter was

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threaded for 4 cm. Three ml of 2%

lidocaine with adrenaline 5mcg/

ml (1/200000) was injected in the

epidural catheter as a test dose. A

bolus dose of 15 ml 0.25% ropivacaine

analgesia was given after

confirming the correct position of

the epidural catheter. Postoperatively,

patients received intermittent

infusion of 25 ml of 0.25% ropivacaine

analgesia at 6 hourly

intervals for 3 successive days.

Extrapleural paravertebral catheter

technique:

At the end of the surgical procedure

and just before closure of

the posterolateral thoracotomy incision,

group A patients received

an extrapleural paravertebral

catheter, based on the technique

originally described by Sabanathan

and coworkers, 1988. The

parietal pleura was stripped off

the posterior chest wall up to the

vertebral bodies for two to three

intercostals spaces above and below

the level of the thoracotomy,

exposing the paravertebral space.

A 16-gauge needle was extended

out of the thorax in the 7th or 8th

intercostals space at the midaxlilaty

line. An epidural-type catheter

was passed through the needle

tip into the thorax then the needle

was removed. The catheter tip was

advanced into the paravertebral

space, under direct vision, to lie

alongside the vertebral column

perpendicular to the intercostal

spaces. The final position of the

catheter was with its lower portion

in the inferior part whereas its tip

in the superior part of the the paravertebral

space. The parietal

pleura was then re-placed and

held in position by absorbable sutures

to prevent leakage of the

perfusate into the pleural cavity. A

bolus dose of 15 ml 0.25% ropivacaine

analgesia was given during

chest closure. Postoperatively, patients

received intermittent infusion

of 25 ml of 0.25% ropivacaine

analgesia at 6 hourly intervals for

3 successive days. An additional

analgesic (75 mg diclofenac sodium)

was given by 1M injection to

any patient in both groups on request

and the lime and frequency

of administrations were recorded.

**Measurements:**

Postoperative pain intensity

was assessed Just after the patient

woke up then at 4 hourly intervals

during the first 48 hours and at 6

hourly interval during the next 24

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hours by verbal rating scale (VRSPrince

Henry pain scale) (Table 1)

(Takamori etal. 2002). Patients

were asked their perceived level of

pain at rest .on deep breathing

and on maximal coughing. Pulmonary

function tests, forced vital

capacity (FVC) and forced expiratory

volume in 1 second (FEV1)

values, were measured before surgery

and at hours 24, 48, and 72

and on day 7 postoperatively.

These tests were performed with

patients relaxed and sitting upright

Postoperative respiratory

complications were recorded.

Muscle strength and range of

shoulder motion (ROSM) were

measured before surgery. ROSM

were repeated daily by the same

examiner. during the first 5 days

postoperatively by asking the patients

to make an abduction of the

ipsilateral arm until pain occurred.

Arterial oxygen saturation

was continuously monitored by a

pulse oxYmeter (Spo2) using a finger

probe until the first postoperative

morning. Samples for blood

gas analyses were obtained from

the radial artery at 6 hourly intervals

for the first 24 hours. The frequency

and time of requested additional

analgesia (NSAI) was

recorded for both groups. Untoward

effects such as hypotension

(decrease of BP by 30% or more

compared with the baseline), confusion,

nausea, convulsions and

vomiting were observed.

Statistical analysis :

Data were presented and analysed

using students t-test and

chi-square test. Statistical analyses

were performed by the SPSS

(version 8) for windows statistical

package. The probability (P) less

than 0.05 was considered significant.

**Results**

Forty patients were qualified

for this study. The characteristics

of these patients and their operative

procedures were shown in

(Table 2). There were no statistically

significant differences between

the 2 patient groups with

respect to age. gender or the procedure

performed (P>0.05). Placement

of the extrapleural catheters

were simple and did not cause any

local problems. Positioning of the

thoracic epidural catheters were

successfully done in all patients.

During the postoperative arou-

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sal period, pain scores were higher

In the extrapleural group than in

the epidural group (P<0.05). Subsequently,

the extrapleural analgesia

provided better pain control

than thoracic epidural analgesia.

The mean values of the verbal rating

scale (VRS) were always less in

group A compared to group B (Table

3). however these differences

were statistically non-significant

(P>0.05). In both groups, no patient

had a pain score of four. The

average analgesic requirements

were always less in group A during

the first five days after surgery.

Preoperative pulmonary fuction

values (FVC and FEV1) were similar

in both groups (P.> 0.05%) (Table

4). Although these values fell

significantly (13<0.05) when measured

at the first postoperative day,

no difference could be seen in theses

changes between both groups

(P>0.05). Although FVC and FEV1

values were gradually increased

over the subsequent 7 days in

both groups, more rapid improvement

was noticed in the extrapleural

paravertebral group, however

these differences were statistically

non-significant (P> 0.05;

Table 4). There was no statistically

significant difference in arterial

blood gases between the 2 groups

during the first 24 hours postoperatively

(P> 0.05).

There was no significant difference

between the two groups regarding

the preoperative range of

shoulder motion (P> 0.05%). Thoracotomy

resulted in a significant

reduction (P<0.005) in both

groups. Although ROSM progressively

increased over the next 5

postoperative days, it was better

noticed among group A patients.

However, these differences

were statistically non-significance

(P>0.05; Table 5). Eight patients

in group A compared to eleven patients

in group B requested additional

analgesia (75 mg diclofenac

sodium, IM).This difference

was statistically non-significant

(P>0.05). No =reality- was recorded

in either group. Morbidity was

recorded solely in group B as 3

(15%) patients developed hypotension

accompanied by bradycardia

that were recovered by IV fluid infusion.

Another 2 (10%) patients

had atelactasis, one of whom required

bronchoscopy and intensive

physiotherapy.