

# Efficacy of Right Superficial Cervical Plexus Block and Intravenous Dexmedetomidine for Relief of Shoulder Pain in Laparoscopic Surgery Under Spinal Anaesthesia: A Feasibility Study

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## Abstract

**Background and Aim:** Laparoscopic procedures are conventionally done under general anaesthesia for avoiding patient discomforts and shoulder pain due to pneumoperitoneum that occur during laparoscopy under spinal anaesthesia. Here a study was designed to look for the possibility of using right superficial cervical plexus block and intravenous dexmedetomidine infusion to reduce shoulder pain in patients undergoing laparoscopic surgery under spinal anaesthesia. **Materials and Methods:** 50 patients of age between 18-60 years with ASA grade I/II undergoing elective laparoscopic surgeries were given spinal anaesthesia with 0.5% hyperbaric bupivacaine and grouped as technique used. Group S (n=25) received right superficial cervical plexus block. Group D (n=25) received Dexmedetomidine intravenously. **Result:** No patients required conversion to general anaesthesia. VDS score for referred shoulder pain was statistically lower in group S compared to group D. Injection dexmedetomidine was associated with lower heart rate and blood pressure. **Conclusion:** Right superficial cervical plexus block is more effective than dexmedetomidine for reduction of referred shoulder pain during laparoscopic surgery under spinal anaesthesia.

**Keywords:** Dexmedetomidine; Laparoscopic Surgery; Referred Shoulder Pain; Right Superficial Cervical Plexus Block.

## Introduction

In modern anaesthesia practice regional anaesthesia gains widespread acceptance for many surgeries including upper abdominal surgeries, thoracic surgeries, laparoscopic surgeries and others. General anaesthesia with endotracheal intubation is the anaesthesia of choice for laparoscopic surgeries since many years. But it is associated with some disadvantages in terms of the stress response, lack of postoperative analgesia, vomiting and postoperative shoulder pain. Regional anaesthesia offers many advantages over general anaesthesia in terms of cost, postoperative analgesia, intact respiratory control mechanism which in turn prevents hypercapnia and complications associated with it. Many studies showed that laparoscopic

surgery can be done safely under spinal anaesthesia. [1-4] Shoulder pain which is a common complication of the laparoscopic surgery can be alleviated by adding various adjuvants to local anesthetics or by giving sedative analgesics during spinal anaesthesia. [5,6,12].

In laparoscopic surgeries, shoulder pain is a referred pain due to irritation of the diaphragm which is supplied by the phrenic nerve. Phrenic nerve is formed in the neck within the cervical plexus having root value C3, C4, C5. Blockade of superficial cervical plexus is easy to perform and results in anaesthesia of cutaneous nerves of anterolateral neck and shoulder. Superficial cervical plexus block has been used to alleviate shoulder pain due to lung surgery and laparoscopic surgery [7-9].

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Injection dexmedetomidine is a newer alpha<sub>2</sub> adrenergic agonist which provides sympatholysis, conscious sedation, anxiolysis and analgesia without respiratory depression. Intravenous as well as intrathecal dexmedetomidine has been used as an adjuvant to hyperbaric bupivacaine for shoulder pain during laparoscopic surgery [12-15]. Hence we designed this research to study the effects of right superficial cervical plexus block and intravenous dexmedetomidine on reduction of shoulder pain, haemodynamic parameters and side effects if any in laparoscopic surgery under spinal anaesthesia.

The primary objective was to study the effect of right superficial cervical plexus block and intravenous dexmedetomidine for relief of shoulder pain in laparoscopic surgery under spinal anaesthesia. The secondary objective was to study the effect on haemodynamic parameters intraoperatively in both groups and side effects if any in both groups.

## Materials and Methods

After receiving approval from the hospital ethical committee and written informed consent, 50 patients of either sex in the age group of 18-60 years belonging to American Society of Anesthesiologists (ASA) physical status I or II scheduled laparoscopic surgery during March 2016 to December 2016 in our institute under spinal anaesthesia were included in this study. The Exclusion criteria included patient refusal, contraindications to spinal anaesthesia, ASA grade > III, weight >80kg, Height <150cm, duration of surgery >120min, patients on medication causing bradycardia, patients with major cardiac, respiratory, liver and renal disease.

All patients were informed about the possibility of conversion to general anaesthesia at any time intraoperatively. All patients underwent a thorough preanaesthesia check up. The verbal descriptor scale for pain (VDS) [0=no pain 2 = mild pain 4=moderate pain 6=severe pain 8=extreme pain 10=worst pain] and the anaesthetic procedure was explained in detail during the pre-anaesthetic visit. All routine blood investigations and other investigations as per need were carried out.

In the operating room, after the establishment of intravenous (IV) line and attachment of standard monitors [non-invasive blood pressure (NIBP), electrocardiography (ECG), and pulse oximetry (SpO<sub>2</sub>)], baseline parameters were recorded and Ringer's solution started intravenously.

Premedication was given with inj.ranitidine 1mg/kg, inj.ondansetron 0.1mg/kg, inj.glycopyrrolate 4mcg/kg, inj. midazolam 0.02mg/kg intravenously. Standard spinal anaesthesia with 25 gauge spinal needle with 3.5-4 ml of 0.5% heavy bupivacaine depending upon the patient height was given in sitting position. After 10 min of spinal anaesthesia as per the convenience of anaesthetist right superficial cervical plexus block or intravenous dexmedetomidine infusion were performed on the patients and grouped as:

*Group S:* received right superficial cervical plexus block at the midpoint of the posterior border of the sternocleidomastoid muscle subcutaneously in a caudad and cephalad direction with 10ml of 0.25% bupivacaine by 24G, 4cm needle.

*Group D:* received inj. dexmedetomidine 1mcg/kg over 10min followed by maintenance dose 0.4 mcg/kg/hr.

All patients were provided with supplemental oxygen via a face mask at a rate of 2-4 L. min<sup>-1</sup> [1] to keep saturation more than 95%. Intra-abdominal CO<sub>2</sub> pressure was kept around 12-14mmHg. All patients were monitored for blood pressure, heart rate and oxygen saturation and recorded every 15min till the end of surgery. Bradycardia was defined as a heart rate of less than 60 beats/minute and was treated with 0.6 mg of intravenous atropine. Hypotension was defined as systolic blood pressure < 90 mmHg and was treated with 50-100 ml of intravenous crystalloid fluid replacement and a bolus of inj.mephentermine 6mg. Patients experiencing shoulder pain intraoperatively with VDS <4 were treated with pentazocine 0.3mg/kg intravenously and those with VDS ≥ 4 were treated with ketamine 0.5-1 mg/kg intravenously. Those patients experiencing shoulder pain even after intravenous ketamine received general anaesthesia and were excluded from the study.

Data was managed in a Microsoft excel spreadsheet. Data was represented as mean, standard deviation, standard error of mean, minimum and maximum observation. Unpaired t test and chi square test was used to compare the results of various parameters. A p value <0.05 was considered statistically significant. All statistical analysis was done using graph prism software.

## Results

There was no statistically significant difference between two groups in demographic data i.e age, weight, height, sex distribution (Table 1). Mean

duration of surgery was 70.2 ± 26.43 in both groups. Both groups were also comparable regarding types of laparoscopic surgeries which included appendectomy (9), cholecystectomy (6), diagnostic scopy(4), hysterectomy (3), ovarian cystectomy (3) (Figure 1).

There was statistically highly significant reduction in VDS score for referred shoulder pain in group S (p<0.001) than group D (Figure 2).

There was statistically very highly significant reduction in mean heart rate in group D than group S (p<0.0001). There was also a statistically very highly significantly lower minimum mean systolic and minimum mean diastolic blood pressure observed in patients receiving dexmedetomidine infusion than in patients receiving right superficial cervical plexus block(p<0.0001) (Table 2).

Side effects observed during surgery are shown in (Table 3). None of the patient complained of nausea,vomiting and respiratory depression from

both groups. Three patients from group S and six patients from D complained of referred shoulder pain. Out of which four patients received inj.pentazocine 0.3mg/kg while three patients was treated with inj.ketamine 0.5mg/kg and two patients required 1mg/kg of inj.ketamine. Two patients experienced abdominal discomfort from group S which was relieved by inj.pentazocine 0.3mg/kg. Bradycardia and hypotension was observed in patients received dexmedetomidine infusion. Bradycardia occurred in ten patients all of whom were corrected by 0.6 mg of atropine. Hypotension occurred in three patients. Two of them were treated with intravenouies fluid while one patient required additional dose of mephentermine 6mg iv.

None of the patient required conversion to general anaesthrsia and all operations were completed laparoscopically without conversion to open surgery.

**Table 1:** Comparison of demographic data and duration of surgery between two groups

Parameters	Group S (Mean±SD)	Group D (Mean±SD)	Remarks
Age (years)	35.48 ±9.691	35.36 ±9.661	P=0.96 NS
Weight (kg)	57.92 ±7.807	57.76 ±7.721	P=0.98 NS
Height (cms)	156.88 ±5.616	156.8 ±5.556	P=0.9 NS
Duration of surgery(min)	70.2 ±26.437	70.2 ±26.437	P=1.00 NS
Sex distribution Male/Female	13/12	13/12	

(P value is significant if p < 0.05 , NS- not significant)

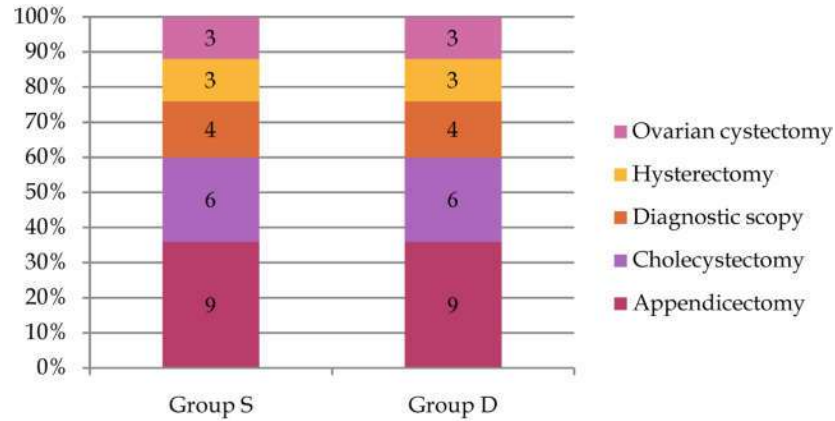
**Table 2:** Comparison of Haemodynamic parameters between two groups

Parameter	Group S ( Mean ± SEM)	Group D ( Mean ±SEM)	Significance
Basal HR	82.72 ± 1.125	82.80 ± 1.143	P=0.964 NS
MIN HR	65.92 ± 0.852	60.20 ± 0.905	P = 0.0001
MAX HR	76.08 ± 0.941	77.04 ± 1.078	P = 0.506 NS
Basal Systolic BP	127 .9 ± 1.892	126 ± 1.911	P = 0.478NS
MIN Systolic BP	102.6 ± 0.955	93.04 ± 0.836	P = 0.0001
MAX Systolic BP	133.6 ± 1.742	132.5 ± 1.218	P= 0.940 NS
Basal Diastolic BP	77.36 ± 1.441	77.92 ± 1.329	P = 0.776 NS
MIN Diastolic BP	62.44 ± 0.938	55.92 ± 0.535	P = 0.0001
MAX Diastolic BP	81.84 ± 1.077	83.44 ± 0.898	P = 0.259 NS

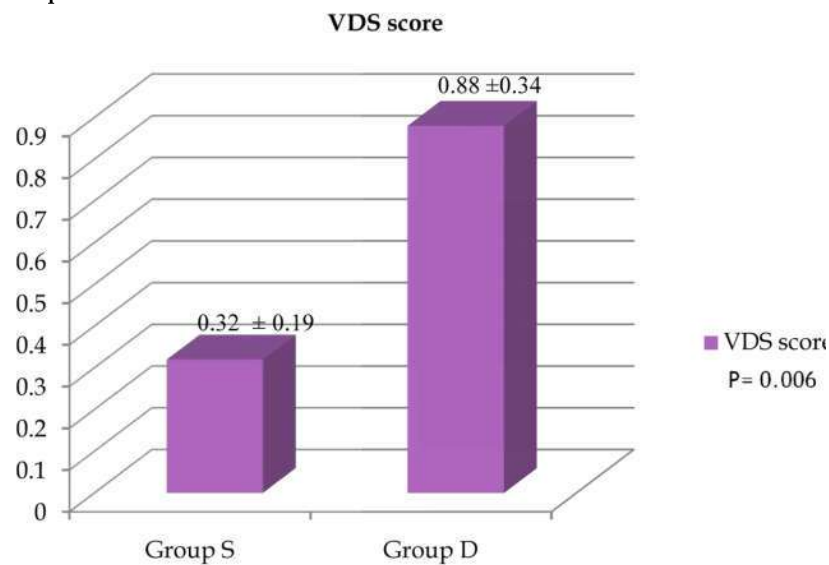
(P value is significant if p<0.05 , NS- not significant)

**Table 3:** Comparison of Side effects between two groups

Parameter	Group S	Group D
Referred shoulder pain	+(3)	+(6)
Nausea, Vomiting	-	-
Bradycardia	-	+(10)
Hypotension	-	+(3)
Abdominal discomfort	+(2)	-
Respiratory depression	-	-



Graph 1:



Graph 2:

## Discussion

In this study, 50 patients underwent laparoscopic surgery under spinal anaesthesia with either right superficial cervical plexus block or intravenous dexmedetomidine infusion though few patients complained of shoulder pain and abdominal discomfort, but these were managed with inj. pentazocine or inj. ketamine.

Proper management of shoulder pain, discomfort, and anxiety during intra-abdominal carbon dioxide pneumoperitoneum is a major concern during the use of regional anaesthesia for laparoscopic surgery. Amongst all carbon dioxide pneumoperitoneum-induced shoulder pain under regional anaesthesia is the most distressing and it is one of the leading cause of conversion to general anaesthesia.

Several studies have been conducted for relief of shoulder pain during laparoscopic surgery under spinal anaesthesia [1-6]. However, very few studies are there on use of right superficial cervical plexus block and dexmedetomidine infusion [10-11,13].

Superficial cervical plexus mainly contains five sensory nerves of which supraclavicular nerve supply anterolateral part of neck and shoulder. Supraclavicular nerve (C4, C5) has same root value as that of phrenic nerve (C3, C4, C5). Blockade of supraclavicular nerve during superficial cervical plexus block results in relief of shoulder pain during laparoscopic surgery under spinal anaesthesia. S.Kanawati et al conducted a study of awake laparoscopic sleeve gastrectomy under paravertebral block with superficial cervical plexus block and observed no shoulder pain in any patient [11]. We found only three patients complained of shoulder pain which may be because of inadequate block.

Analgesia with dexmedetomidine is mainly due to two mechanisms.

- a. Efflux of potassium ions results in hyperpolarization of the excitable cell membrane which in turn causes decrease in neuronal firing.
- b. Suppression of calcium ion entry causes decrease in release of neurotransmitter and terminates pain signals. Analgesic and sedative effects of dexmedetomidine is expected to resolve the shoulder pain and abdominal discomfort during laparoscopic surgery under spinal anaesthesia. Two studies reported 24 out of 60 patients and 8 out of 26 patients complaining of referred shoulder pain while using intravenous dexmedetomidine [11,13]. We also observed 6 patients out of 25 complaining of shoulder pain. It might be because of fixed dose of dexmedetomidine infusion for different types of laparoscopic surgery where severity shoulder pain differs and resulted in inadequate analgesia.

Hypotension and bradycardia are common adverse effects associated with dexmedetomidine as well as with spinal anaesthesia. The incidence of dexmedetomidine-related hypotension and bradycardia were 30% and 9% respectively, in a phase-III study of 401 patients [15]. The incidence of hypotension, but not of bradycardia, increases as the dose of dexmedetomidine increases [16]. In contrast, a meta-analysis study showed that dexmedetomidine use during spinal anaesthesia is associated with more frequent bradycardia but did not increase the incidence of hypotension [12]. In another study too there was a higher incidence of bradycardia than hypotension [13]. We also observed a higher incidence of bradycardia than hypotension in our study.

The low incidence of hypotension and high incidence of bradycardia in the present study may have been due mainly to the effects of pneumoperitoneum. At intra-abdominal pressures of <15 mmHg, venous return, cardiac filling pressure, and cardiac output are increased as blood is squeezed from the splanchnic venous bed and by sympathetically mediated peripheral vasoconstriction [17]. In addition, insertion of the veress needle or trocar and pneumoperitoneum-induced peritoneal stretching can cause vagal stimulation, which can lead to significant bradycardia [18].

In our study none of patient complained of nausea and vomiting. This result correlates with the another study where there was a 11 fold decreased risk for nausea and vomiting in patients receiving regional anaesthesia compared to general anaesthesia [19].

There were several limitations to this study. This observational study was done in very small population. There was no control group or placebo for comparison. Two different techniques were studied, one was block and other was drug infusion which has different mechanisms for relief of shoulder pain. We did not evaluate effects of various maintenance doses of dexmedetomidine (0.2-0.7mcg/kg/hr). We included different types of laparoscopic surgery where intensity of shoulder pain may not remain the same.

## Conclusion

Our study concluded that both right superficial cervical plexus block and dexmedetomidine infusion are feasible for relief of shoulder pain during laparoscopic surgery under spinal anaesthesia. Right superficial cervical plexus block is more effective than dexmedetomidine infusion for relief of shoulder pain during laparoscopic surgery under spinal anaesthesia. Dexmedetomidine infusion was associated with more haemodynamic alteration with increasing incidence of bradycardia. However careful monitoring and adequate dose adjustment helped us tide over this issue.

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