A Prospective Study to Compare the Effects of General Anaesthesia and Regional Anaesthesia among Patients Posted for Laparoscopic Appendicectomy, in SV Medical College, Tirupati, Andhra Pradesh

B. Nirmala Devi[1], Surisetty Sreenivasa Rao[2], Raju Bhukya[3]

[1]Department of Obstetrics and Gynaecology, S.V. Medical College, Tirupati, Andhra Pradesh, India.
[2]Department of Anaesthesiology, ACSR Government Medical College, Nellore, Andhra Pradesh, India.
[3]Department of Anaesthesiology, S.V. Medical College, Tirupati, Andhra Pradesh, India.

ABSTRACT

BACKGROUND

We wanted to compare the effects of general anaesthesia and regional anaesthesia in cases posted for laparoscopic appendicectomy and also compare various parameters like hemodynamic changes, postoperative analgesia, and postoperative complications in both the techniques.

METHODS

After obtaining permission from scientific and ethical committee of SVMC, Tirupati, we conducted the study on 60 patients attending SV Medical College, Tirupati from September 2018 to August 2019, who were in ASA GRADE 1 & 2, and posted for laparoscopic appendicectomy. We divided them into two groups Group - S – those who received spinal anaesthesia & Group - G – those who received general anaesthesia.

RESULTS

60 patients of ASA 1 and 2 were taken up for laparoscopic appendicectomy from September 2018 to August 2019. Out of 60 patients, 30 patients were grouped under Group - S, Other 30 patients grouped under Group - G. Intraoperative vitals, including blood pressure, heart rate, oxygen saturation, and respiratory rate and end-tidal CO2 levels, were within baseline values, whereas postoperative analgesia was better in Group - S than Group - G. There were 3 patients in the spinal group who developed postoperative hypotension and were managed with injection mephentermine sulphate. Out of 30 in each group, 11 patients in spinal, and 22 patients in GA group developed postoperative nausea and vomiting, which subsided with antiemetics. There were 4 patients in spinal, and 3 patients in the GA group who complained of shoulder tip pain in the postoperative period. Patients had minimal pain and no requirement of analgesia in the initial 3 hours of the postoperative period in the spinal group.

CONCLUSIONS

Patients who underwent laparoscopic appendicectomy under spinal anaesthesia (Group - S) showed significant postoperative analgesia (P - value < 0.05) and better haemodynamic stability than the patients who underwent laparoscopic appendicectomy under general anaesthesia (Group - G), But alertness for any emergency by anaesthesiologist was more needed in spinal anaesthesia than general anaesthesia because airway was not protected, and patient was taking spontaneous respirations.

KEYWORDS

RA - Regional Anaesthesia, SA - Spinal Anaesthesia, GA - General Anaesthesia, PONV (Postoperative Nausea & Vomiting)

Corresponding Author:
Dr. Surisetty Sreenivasa Rao,
Department of Anaesthesiology,
ACSR Government Medical College,
Nellore, Andhra Pradesh, India.
E-mail: surisetty72@gmail.com

DOI: 10.18410/jebmh/2021/435

How to Cite This Article:
Devi BN, Rao SS, Bhukya R. A prospective study to compare the effects of general anaesthesia and regional anaesthesia among patients posted for laparoscopic appendicectomy, in SV Medical College, Tirupati, Andhra Pradesh. J Evid Based Med Healthc 2021;8(26):2333-2338. DOI: 10.18410/jebmh/2021/435

Submission 26-12-2020,
Peer Review 06-01-2021,
Acceptance 13-05-2021,
Published 28-06-2021.

BACKGROUND

Over a century ago, laparoscopy was first introduced as a therapeutic alternative to laparotomy. Since then, the field of laparoscopic surgery has evolved and grown tremendously, to the extent that it has now become a conventional approach for many surgical diseases traditionally treated with open procedures. Improved surgical cosmetics, reduced post-operative pain, faster return to work, and lower surgical related complications continue to make laparoscopy, in many cases, preferable to open surgery.[1,2] Advances in anaesthesia have also facilitated the expansion of laparoscopy. Today, a large number of surgeries that once required, prolonged hospital stays are now performed in outpatient surgery centres and short stay facilities.[3,4]

Direct mechanical stress on the patient as well as on neuroendocrine system during laparoscopy are the primary forces responsible for much of the physiologic derangement observed, that is systemic hypertension, respiratory insufficiency and the risk of venous gas embolism. As well the pathophysiologic changes caused by extraperitoneal gas insufflation and extremes of patient positioning.[5,6] Laparoscopic surgeries are generally performed under general anaesthesia with endotracheal intubation to prevent aspiration and respiratory complications secondary to induction of pneumoperitoneum and also prevent respiratory discomfort and shoulder pain due to stretching of the diaphragm in patients who are awake during the procedure. Consequently, the use of regional anaesthesia (RA) in laparoscopic surgery has been limited to patients at high risk for general anaesthesia due to severe coexisting pulmonary, cardiac, or other diseases.[6-9] Physiologic changes during minimally invasive surgery are well tolerated in healthy patients, minimizing complications and optimizing conditions for a successful surgical result, requires an understanding of the interplay between physiology and laparoscopic surgery.

Objectives

1. To compare the effects of GA versus RA in cases posted for laparoscopic appendicectomy.
2. To compare hemodynamic variability, postoperative analgesia, postop nausea and vomiting (PONV) in patients undergoing laparoscopic appendicectomy under spinal and general anaesthesia.
3. To compare surgeon's satisfaction in patients undergoing laparoscopic appendicectomy under spinal and general anaesthesia.
4. To compare adverse complaints (Intraop & Postop) in patients undergoing laparoscopic appendicectomy under spinal and general anaesthesia.

METHODS

It is a hospital based interventional and prospective study conducted for a period of 1 year from September 2018 to August 2019 in which 60 patients of both the genders diagnosed with appendicitis and posted for laparoscopic appendicectomy in Sri Venkateswara Ramnarain Ruia government general hospital, Tirupati attached to S. V. Medical College were included for the study.

Sample Size

By using simple random technique, we selected the first 60 patients from the date of approval by Institutional scientific and Ethical Committee over a period of one year.

Inclusion Criteria

1. ASA physical grade 1 and 2 patients
2. Patients belonging to age group of 14 - 50 years of either gender
3. Patients who are willing to give written and informed consent for the study
4. Patients posted for either elective or emergency laparoscopic appendicectomy

Exclusion Criteria

1. Pregnant and lactating women
2. Morbidly obese patients
3. Patients with spine deformity
4. Patients with known systemic diseases, like coronary artery disease (CAD), stroke, renal failure, liver failure, etc.

After the approval of Institutional Scientific and Ethical Committee, written informed consent was obtained from 60 American Society of Anesthesiologists (ASA) Grade I and II patients undergoing either elective or emergency laparoscopic appendicectomy. They were allocated randomly into two groups, spinal anaesthesia (Group - S) and general anaesthesia (Group - G) meeting exclusion and inclusion criteria. The patients were explained during the preoperative visit by the anaesthesiologist that any anxiety, pain, or discomfort occurring during surgery would be dealt with intravenous medications or if required, converted to general anaesthesia. In Group - S, during and after the procedure, the patients were encouraged to report any discomfort, abdominal or shoulder pain, nausea, and vomiting. All patients received oral Tab alprazolam 0.25 mg (wt. < 50 kg) or 0.5 mg (wt. > 50 kg) on the night prior to surgery. In the operative room, an intravenous line secured, and all patients received adequate preloading with 1000 ml of Ringer's lactate solution for over 15 min and intravenous injection ondansetron 4 mg.

All routine monitors, namely, non-invasive blood pressure, pulse oximetry (SpO2) and electrocardiogram, ETCO2, were attached, and baseline values of vital signs were recorded. The patients were positioned in the left lateral position, and the L2 - L3 / L3 - L4 space was palpated. Under strict aseptic precautions, the sub-arachnoid block was given using 25G spinal needle to determine the subarachnoid space.

Spinal anaesthesia was then performed with 4 ml (20 mg) of 0.5 % heavy bupivacaine injected into L2 - L3 / L3 - L4 subarachnoid space after free flow of clear cerebrospinal fluid. The patients were then turned to the supine position and a 10-degree Trendelenburg tilt was given to achieve the required level of block, as assessed by pinprick / cold temperature method. Heart rate, Respiratory rate, ECG, ETCO2, SpO2 and blood pressure were recorded every 5 min for the duration of surgery.

Once the block was considered adequate (minimum block T4, as assessed by pinprick / cold temperature), surgery was commenced using carbon dioxide (CO2) insufflation at a maximum pressure limit of 12 mmHg. Anxiety was treated with IV midazolam 2 mg in divided doses and if required, IV injection ketamine 0.5 mg / kg + injection glycopyrrolate 0.2 mg was titrated to a level of sedation, after deep sedation laryngeal mask airway (LMA) was passed and ETCO2 connected to measure the end tidal CO2. Hypotension was treated with IV fluids, or if required, IV mephentermine 6 mg as IV bolus and 6 mg was repeated as and when required during the intraoperative period and postoperative period. The surgical procedure was carried out according to a standard protocol with no modification.

In Group - G, premedication was administered before induction of anaesthesia to all the patients in the form of injection midazolam 0.05 mg / kg, and injection ondansetron 0.1 mg / kg, + injection glycopyrrolate 0.2 mg. After preoxygenation with 100 % oxygen, patients were induced with injection fentanyl 2 mcg / kg, injection propofol 2 mg / kg, and injection suxamethonium 2 mg / kg.

Endotracheal intubation was done with appropriate size endotracheal tube, cuff inflated, and it was secured. Anaesthesia was maintained with oxygen, nitrous oxide (50: 50), sevoflurane 1 MAC and Inj: vecuronium 0.02 mg / kg. All patients in group - G were mechanically ventilated using a circle system. Respiratory rate (RR) and tidal volume (T V) were adjusted according to ideal body weight to keep the ETCO2 between 35 and 45 mmHg. Intra-abdominal pressure was maintained between 12 and 14 mmHg throughout the laparoscopic procedure. Operative time, as well as any intraoperative event, was recorded. Postoperatively all patients with VAS (Visual Analogue Scale) score > 4 were given IV Paracetamol 1 gm or Diclofenac Sodium 100 mg, rectal suppository for postoperative pain relief.

Data Analysis

Data were entered into MS excel sheet and analysed by using Epi info 7.1 version. The categorical variables were expressed as proportions while the continuous variables recorded as Mean and standard deviation. The differences between proportions were analysed using chi-square test with necessary corrections if any. A probability value of less than 0.05 was considered to be statistically significant. The results are tabulated as shown below.

RESULTS

60 patients of ASA 1 and 2 were taken up for laparoscopic appendicectomy. Out of 60 patients, 30 patients were grouped under Group - S, which included 13 males, 17 females with an avg. age of 25.5 years and the surgery lasted for an avg. duration of 64.17 min. Other 30 patients grouped under Group - G, which included 8 males and 22 females with an avg. age of 25.8 years and the surgery lasted for an avg. duration of 81.83 min.

Procedure	Male	Female	Total
Spinal anaesthesia	13 (43.3 %)	17 (56.7 %)	30
General anaesthesia	8 (26.7 %)	22 (73.3 %)	30

Table 1. Demographic Data

Spinal (Group - S): Avg. age (Yrs.) 25.5, Sex Ratio M: F (N) 13: 17, Avg. Duration of Surgery (Min) 64.17.
GA (Group - G) : Avg. age (Yrs.) 25.8, Sex Ratio M : F (N) 08 : 22, Avg. Duration of Surgery (Min) 81.83

Procedure	PONV	Shoulder Pain	Headache	Hypotension
Spinal anaesthesia	11 (36.6 %)	4 (13.3 %)	3 (10.0 %)	3 (10.0 %)
General anaesthesia	22 (73.3 %)	3 (10.0 %)	4 (13.3 %0	0 (0 %)
Total	**33 (55 %)**	**7 (11.6 %)**	**7 (11.6 %)**	**7 (11.6 %)**

Table 2. Complications Postoperatively

Spinal (Group - S): Postoperatively 11 patients developed PONV, 4 patients developed shoulder tip pain, 3 developed headaches, and 3 developed hypotension.
GA (Group - G): Postoperatively 22 patients developed PONV, 3 patients developed shoulder tip pain, and 4 developed headaches. 73.3 % under GA got PONV, more significant than SA

Procedure	Satisfied	Very Much Satisfied	Total
Spinal anaesthesia	5 (16.7 %)	25 (83.3 %)	**30**
General anaesthesia	9 (30.0 %)	21 (70.0 %)	**30**
Total	**14 (23.3 %)**	**46 (76.7 %)**	**60**

Table 3. Surgeon Satisfaction

Surgeons were better satisfied in spinal (Group - S) than GA (Group - G).

			Rescue Analgesia When VAS Score > 4 in Postop Period				
			< 30 min	30 min – 1 h	1 h – 3 h	3 h – 6 h	6 h – 12 h
Groups	Spinal	count	00	00	00	14	16
	GA	count	08	15	07	09	18
Significance		Pearson chi - square (2 - sided)	.002	.000	.005	Not significant	Not significant

Table 4. Rescue Analgesia VAS > 4 (Postoperative Period)

There was no rescue analgesia during the first 3 hours of postoperative period under Spinal (Group - S)

Time Map in Minute	Spinal Anaesthesia	General Anaesthesia
MAP 0	81.6	80.0
MAP 5	73.6	74.3
MAP 10	77.4	78.1
MAP 15	83.4	83.1
MAP 20	87.7	87.8
MAP 25	90.9	91.5
MAP 30	92.7	93.7
MAP 35	94.8	95.2
MAP 40	96.8	96.9
MAP 45	96.6	95.9

Table 5. Comparison of Changes in Mean Arterial Blood Pressure (MAP) in Both Groups : Spinal (Group - S) & GA (Group - G) Average

There was no significant variation in Mean arterial blood pressure (MAP) in both the groups

All 60 surgeries were completed laparoscopically, and no conversion of anaesthesia was required. Patients responded well, and the surgery was completed without any pain. Intraoperative vitals, including blood pressure, heart rate, oxygen saturation, and respiratory rate and end-tidal CO2 levels, were within baseline values, whereas postoperative analgesia was better in Group - S than Group - G.

There were 3 patients in the spinal group who developed postoperative hypotension and were managed with injection mephentermine sulphate (Table 2). Out of 30 in each group, 11 patients in spinal, and 22 patients in GA group developed postoperative nausea and vomiting, which subsided with antiemetics. There were 4 patients in spinal, and 3 patients in the GA group who complained of shoulder tip pain in the postoperative period. Patients had minimal pain and no requirement of analgesia in the initial 3 hours of the postoperative period in the spinal group.

DISCUSSION

Laparoscopic surgery has evolved and grown tremendously, to the extent that it has now become a conventional approach for many surgical diseases traditionally treated with open procedures.[10-13] Laparoscopic surgeries are generally performed under GA with endotracheal intubation to prevent aspiration and respiratory complications secondary to induction of pneumoperitoneum, but GA does not provide good postoperative analgesia and emesis free recovery.[5,6] RA per se is considered to be superior to GA in terms of safety, less postoperative complications, and better pain management.[6-9] The goal of the anaesthetic management in these patients include the management of complications related to pneumoperitoneum, as well as achieving an adequate level of sensory blockade, postoperative pain relief, stabilizing the respiratory mechanics, and ambulation at earliest.

Spinal and combined spinal and epidural anaesthesia (CSE) will fulfil all the above criteria, and aids in the quick and uneventful postoperative recovery and thus has been suggested to be a suitable alternative anaesthetic method for laparoscopic surgeries.[14] One of the concerns for performing laparoscopic surgery under RA is lack of adequate anterior abdominal wall relaxation to the surgeon, which could hinder view of abdominal contents. In fact, many authors have listed this problem in their studies.[15] However, in our study abdominal wall relaxation was sufficient in all the 30 patients of Group - S, with a higher level of subarachnoid block.

Under RA, the respiratory mechanism remains intact, and the diaphragm is unaffected, allowing the patient to adjust minute ventilation without any significant changes in respiratory rate or CO2 levels.[16] In a study conducted by Ciofolo et al.[17] the ventilator values and arterial blood gas analysis were maintained within normal limits at different stages during laparoscopy under epidural anaesthesia. Data from healthier women undergoing laparoscopic surgery, under RA with CO2 insufflation suggested that PaCO2 did not rise during surgery because women who were awake adjusted the respiratory rate and minute ventilation.[17-20] In our study, we did not monitor arterial blood gases but monitored SpO2, ETCO2, and the respiratory rate, all were with in normal limits. Cardiovascular changes were also minimal. 3 patients (10 %) under Group - S required one-time support with Injection mephentermine sulphate bolus dose of 6 mg for hypotension. Sinha et al. noted that an incidence of hypotension was 20.5 % in their study,[21] With an added advantage of decrease in surgical bed oozing because of hypotension, and improved venous drainage associated with spinal anesthesia.[22]

Shoulder tip pain is a common and troublesome problem during laparoscopic surgery under RA. This is a referred pain due to the stretching of the diaphragm by insufflating abdomen with CO2, as cervical root which supplies the diaphragm is spared during regional anaesthesia. Overall, the reported rate of conversion from RA to GA due to intolerable shoulder pain has been 0 - 37.1 % for lap. cholecystectomy.[16,21,23-26] However such conversion was not required in our study. In our opinion IV sedation with Injection ketamine 0.5 mg / kg helped in better management of shoulder tip pain.

In addition, the use of low-pressure pneumoperitoneum (< 10 mmHg) decreases shoulder tip pain incidence and severity,[27] but it adds the difficulty to the surgeon. However, in our study except for Injection ketamine, no other above mentioned techniques were used. We suggest injection ketamine to be an easier and better method for shoulder tip pain management. However, a larger and better - randomized study will be required to establish its advantage. Urinary retention and the need for urinary catheterization would be a serious disadvantage of RA in healthy patients.[28] However, no long term catheterization was required and was easily managed with no significant morbidity. Advantage of regional anaesthesia was the reduced incidence of postoperative nausea vomiting (PONV). In addition adequate hydration reduced systemic opioid use, and preoperative prophylaxis by injection ondansetron also resulted in reduced incidence of PONV. However, 11 patients in group - S and 22 patients in group - G developed nausea and vomiting during postoperative period, and required antiemetics.

PONV has been particularly troublesome after GA because of the use of opioids, nitrous oxide and also reversal agents. Antiemetics may be required in as many as 50 % of patients[29] and could result in a delay in discharge from the hospital in nearly 7 % of patients.[23] RA resulted in prolonged postoperative analgesia, which resulted in a smooth and uneventful recovery of the patient. Complications like sore throat, relaxant - induced muscle pain, and dizziness were absent in patients who received regional anaesthesia, whereas these were commonly encountered in GA patients. Overall there was a good patient and surgeon satisfaction, and most importantly, very few complications make regional anaesthesia a good and preferred option for conducting laparoscopic appendicectomy. However, further studies and large randomized control trials (RCT)s are required to establish their benefits over GA.

From the study, we ensure the operative and postoperative advantages and the safety of regional anaesthesia over GA, which makes it a better choice of

anaesthesia for conducting laparoscopic appendicectomy. In this study we did not include cost analysis, but other studies indicated that laparoscopic surgeries under regional anaesthesia were more cost effective than GA. This makes the regional anaesthesia an attractive option for laparoscopic appendicectomy, especially in developing countries.

CONCLUSIONS

Laparoscopic surgeries have really revolutionized abdominal surgeries and have drastically reduced the morbidity, mortality, and length of hospital stay. Whereas GA negated some of the advantages of laparoscopic surgeries. We did these surgeries under regional anaesthesia safely without any modification of the surgical technique. Additionally, it appears that regional anaesthesia has more stable haemodynamics, good postoperative pain control and surgeon satisfaction. However, this approach requires a co-operative patient, an experienced surgeon and an enthusiastic anaesthesiologist ever prepared to supplement it with appropriate intravenous adjuvant and if needed conversion to a general anaesthesia. From these, we conclude that with proper application and with suitable improvements, regional anaesthesia has got the potential to emerge as standard anaesthetic technique for laparoscopic appendicectomy. However, further larger randomized controlled trials are required to compare regional anaesthesia with general anaesthesia in terms of cost, benefits, and risks while conducting laparoscopic appendicectomy.

Limitations

1. Majority of the patients included were between 14 and 50 years with MPG 1 and ASA1.
2. Study limited to the lap. appendicectomy.
3. The study was not done in above 50 years' age group and below 14 years.
4. The study was not done in patients with obesity, obstructive sleep apnea (OSA), chronic obstructive pulmonary disease (COPD), CAD, ASA above 3, and other systemic diseases.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

[1] Weinberg L, Rao S, Escobar PF. Robotic surgery in gynecology: an updated systematic review. Obstet Gynecol Int 2011;2011:852061.
[2] Finkelstein J, Eckersberger E, Sadri H, et al. Open versus laparoscopic versus robot-assisted laparoscopic prostatectomy: the European and US Experience. Rev Urol 2010;12(1):35-43.
[3] Gurusamy KS, Junnarkar S, Farouk M, et al. Day-case versus overnight stay in laparoscopic cholecystectomy. Cochrane Database Syst Rev 2008;(3):CD006798.
[4] Thomas H, Agrawal S. Systematic review of day-case laparoscopic fundoplication. J Laparoendosc Adv Surg Tech A 2011;21(9):781-788.
[5] Chui PT, Gin T, Oh TE. Anaesthesia for laparoscopic general surgery. Anaesth Intensive Care 1993;21(2):163-171.
[6] Gerges FJ, Kanazi GE, Jabbour-Khoury SI. Anesthesia for laparoscopy: a review. J Clin Anesth 2006;18(1):67-78.
[7] Gramatica L Jr, Brasesco OE, Luna AM, et al. Laparoscopic cholecystectomy performed under regional anesthesia in patients with chronic obstructive pulmonary disease. Surg Endosc 2002;16(3):472-475.
[8] Pursnani KG, Bazza Y, Calleja M, et al. Laparoscopic cholecystectomy under epidural anesthesia in patients with chronic respiratory disease. Surg Endosc 1998;12(8):1082-1084.
[9] Sulemanji DS, Donmez A, Arslan G. Epidural anaesthesia for laparoscopic cholecystectomy in a patient with scleroderma. Br J Anaesth 2006;97(5):749.
[10] Hendolin HI, Paakonen ME, Alhava EM, et al. Laparoscopic or open cholecystectomy: a prospective randomised trial to compare postoperative pain, pulmonary function and stress response. Eur J Surg 2000;166(5):394-399.
[11] Zacks SL, Sandler RS, Rutledge R, et al. A population based cohort study comparing laparoscopic cholecystectomy and open cholecystectomy. Am J Gastroenterol 2002;97(2):334-340.
[12] Chui PT, Gin T, Oh TE. Anaesthesia for laparoscopic general surgery. Anaesth Intensive Care 1993;21(2):163-171.
[13] Fielding GA. Laparoscopic cholecystectomy. Aust N Z J Surg 1992;62(3):181-187.
[14] Tzovaras G, Fafoulakis F, Pratsas K, et al. Spinal vs general anesthesia for laparoscopic cholecystectomy. Arch Surg 2008;143(5):497-501.
[15] Azurin DJ, Go LS, Cwik JC, et al. The efficacy of epidural anesthesia for endoscopic preperitonealherniorrhaphy: a prospective study. J Laparoendosc Surg 1996;6(6):369-373.
[16] Van Zundert AA, Stultiens G, Jakimowicz JJ, et al. Laparoscopic cholecystectomy under segmental thoracic spinal anaesthesia: a feasibility study. Br J Anaesth 2007;98(5):682-686.
[17] Ciofolo MJ, Clergue F, Seebacher J, et al. Ventilatory effects of laparoscopy under epidural anesthesia. Anesth Analg 1990;70(4):357-361.
[18] Nishio I, Noguchi J, Konishi M, et al. The effects of anesthetic techniques and insufflating gases on ventilation during laparoscopy. Masui 1993;42(6):862-866. [In Japanese]
[19] Subba B, Gupta I, Singh H. Studies of cardiovascular and arterial blood gas changes during carbon dioxide

pneumoperitoneum for laparoscopic sterilization under general anaesthesia versus local anaesthesia. Asia Ocean J Obstet Gynaecol 1991;17(1):31-35.
[20] Diamant M, Benumof JL, Saidman LJ, et al. Laparoscopic sterilization with local anesthesia: complications and blood-gas changes. Anesth Analg 1977;56(3):335-337.
[21] Sinha R, Gurwara AK, Gupta SC. Laparoscopic cholecystectomy under spinal anesthesia: a study of 3492 patients. J Laparoendosc Adv Surg Tech A 2009;19(3):323-327.
[22] Casey WF. Spinal anaesthesia: a practical guide. Pract Proced 2000;12:1-7.
[23] Hamad MA, El-Khattary OA. Laparoscopic cholecystectomy under spinal anesthesia with nitrous oxide pneumoperitoneum: a feasibility study. Surg Endosc 2003;17(9):1426-1428.
[24] Yuksek YN, Akat AZ, Gozalan U, et al. Laparoscopic cholecystectomy under spinal anesthesia. Am J Surg 2008;195(4):533-536.
[25] Sefiani T, Uscain M, Sany JL. Laparoscopy under local anaesthesia and hypnoanaesthesia about 35 cholecystectomies and 15 inguinal hernia repair. Ann Fr Anesth Reanim 2004;23(11):1093-1101.
[26] Gautam B. Spinal anaesthesia for laparoscopic cholecystectomy: a feasibility and safety study. Kathmandu Univ Med J 2009;7(28):360-368.
[27] Sarli L, Costi R, Sansebastiano G, et al. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy. Br J Surg 2000;87(9):1161-1165.
[28] Palachewa K, Chau-In W, Naewthong P, et al. Complications of spinal anesthesia at Stinagarind hospital. Thai J Anesth 2001;27(1):7-12.
[29] Nathanson LK, Shimi S, Cuschieri A. Laparoscopic cholecystectomy: the Dundee technique. Br J Surg 1991;78(2):155-159.