World Journal of Surgery and Surgical Research

Research Article
Published: 10 Sep, 2021

Spinal and Epidural Anesthesia for Laparoscopic Abdominal Surgery: 84 Procedures

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Abstract

From its origins, abdominal surgery has benefited from the advantages of general anesthesia. At the end of 20th century, regional anesthesia, as well as minimally invasive surgery, made a significant appearance. Thoracic neuraxial anesthesia has been used in major abdominal surgery and in oncology, on patients who, due to cardiorespiratory problems, could not undergo GA. Given the good results obtained, the method was also applied to patients in good conditions. CESA (combined epidural and spinal anesthesia) is emerging for minimally invasive surgery. Cases of open major abdominal surgery under neuraxial anesthesia have been collected in a few centers, but none of the series was laparoscopic.

This article is a series of 84 patients undergoing abdominal surgery, partly for neoplasms, operated in laparoscopy and neuraxial anesthesia. Depending on the type of intervention, especially in the intra-abdominal operating region, the anesthetic techniques were different, spinal, epidural or combined. In two cases there was a need to convert the intervention into GA. Most of the patients were classified as ASA II or III. The interventions were carried out with conscious and cooperative patients, with complete abdominal muscle relaxation. No cases required intensive postoperative care.

In the COVID era, neuraxial anesthesia represents a significant opportunity to avoid the risk of respiratory contamination for the person operating anesthesia.

Keywords: Abdominal Surgery; Neuraxial anesthesia; Spinal; Peridural; Laparoscopy

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Received Date: *05 Aug 2021*
Accepted Date: *31 Aug 2021*
Published Date: *10 Sep 2021*

Citation:
Santoro E, Colace L, Pedullà G, Pullano C. Spinal and Epidural Anesthesia for Laparoscopic Abdominal Surgery: 84 Procedures. World J Surg Surgical Res. 2021; 4: 1334.

Introduction

From its origins, abdominal surgery has benefited from the advantages of General Anesthesia (GA). At the end of 20th century, regional anesthesia, as well as minimally invasive surgery, made a significant appearance. In a short time, both of these methods, anesthesiologic and surgical, have conquered a vast field. The neuraxial, peridural and spinal anesthesia at the lumbar level have long been widely used methods in gynecological surgery, obstetrics [1-4], endourology, perineum surgery [5], and lower limb surgery, inguinal and femoral hernias. Occasionally, thoracic neuraxial anesthesia have been used in major abdominal surgery and in oncology [6-8], including breasts [9]. Thoracic neuraxial anesthesia was initially used to operate on patients who, due to cardiorespiratory problems, could not undergo GA. Given the good results obtained, the method was also applied to patients in good conditions [10,11].

With the 21st century, video laparoscopic surgery has supplanted open surgery (operations on the uterus, bladder, prostate, rectum and colon, kidney, stomach, biliary tract, spleen, on the body and tail of the pancreas). More recently, laparoscopic surgery has extended to the head of the pancreas and the hepatic parenchyma. After initial uncertainties, they have been validated for the whole abdominal surgical oncology.

At the same time, anesthesia is seeking new horizons through the use of regional anesthesia: Thus, the so-called CESA (combined epidural and spinal anesthesia) is emerging for minimally invasive surgery as well. Incredibly, this technique has found early applications for open and closed abdominal cholecystectomy, especially in countries with organizational problems, (Brazil, Egypt, India), perhaps because the shortage of anesthetists has prompted surgeons to practice this technique in person. Strengthened by the experience gained in traditional open surgery with neuroaxial anesthesia, in laparoscopic surgery the applications have started directly in ASA I-II patients [12], with appendectomy [13,14], cholecystectomy and hysterectomy [14,15], then with case comparisons between GA and CESA [16,17], and finally with the extension of CESA to cases of

particular complexity, as asthma [18], chronic obstructive pulmonary diseases [19], and Parkinson's disease [20].

The results in laparoscopic surgery were favorable, with collaborating patients, good muscle relaxation, and rare need for conversion from CESA to GA, especially in the learning curve [13], with excellent postoperative courses, and the possibility of discharge even on the same evening of the operation [12]. Complications of spinal anesthesia are exceptional (hematomas in the vertebral canal), already known for lumbar punctures for clinical-diagnostic [21,22].

In the present case series, which was undertaken between January 2019 and June 2020, the CESA was applied to any type of abdominal pathology and to any surgery (open abdomen and laparoscopy). Informed consent to participate in the study was obtained from participants. Methods were carried out in accordance with relevant guidelines and regulations, and all experimental protocols were approved by San Camillo Foundation. The choice of patients to be operated on in CESA was random. In the choice between open and laparoscopic surgery, the extent of the tumour, the severity of the inflammation, the pancreatic site, obesity, and the decision of the patient were decisive. An equal number of patients were operated on with simple spinal anesthesia and with CESA, while a few were operated with the epidural alone. In the same period, the same surgeons operated a greater number of cases with open abdomen and above all in laparoscopy, under GA.

Materials and Methods

Case studies

This study is the analysis of 84 cases of neuraxial anesthesia in patients undergoing abdominal surgery performed laparoscopically in all the cases, operated in an 18-month period at the Villa Pia Clinic in Rome, in agreement with the National Health Service, between January 01st, 2019 and June 30th, 2020 by the same team, composed of three surgeons and an anesthetist who signed this publication, on behalf of the San Camillo - Forlanini Foundation of Rome.

There were 42 males and 42 females aged between 25 and 89, with an average age of 62.3 (Table 1) operated in VLS for colon pathologies in 41 cases, for gallbladder in 32 cases, for other pathologies in 11 cases (Table 2). Of these cases, 23.8%, or 20, were malignant neoplasms, while over 65% of the remaining cases were delayed emergencies for inflammatory diseases, often fevered (Table 3). No procedures were converted from laparoscopy to open surgery. From an anesthetic point of view, 81% of patients ranged from ASA 2 to 3 (Table 4). The anesthetic technique was spine associated with epidural in 34 cases of colic surgery; the simple spinal in cholecystectomies and in a few other cases; spinal anesthesia alone was in 8 cases of short pelvic or subumbilical surgery (Table 5). The duration of the operations (and of the anesthesia) was less than one hour in 22% cases, between one and two hours in 55% cases, and over two hours in 22% cases (Table 6).

In one patient, the occurrence of respiratory distress during laparoscopic surgery for bilateral inguinal hernia suggested the conversion of spinal anesthesia to GA. In another patient, 80 years old, arthritic, and obese, the difficulty of reaching the vertebral space made the administration of drug uncertain and therefore GA was continued.

Anesthetic Technique

No premedication, no nasogastric tube, no invasive monitoring.

Patient sitting sideways in the operating bed. The anesthetist is behind the patient.

Disinfection of the back, identification of the selected intervertebral spaces where local anesthesia is carried out by direct infiltration under the skin and muscles for the entire length of the needle, i.e. for about 3 cm in depth.

Combined epidural-spinal anesthesia - CESA

Directions: patients <50 years, procedure >90 min.

Procedure: a. epidural catheter is applied; b. spinal puncture is performed; c. drug introduced *via* epidural catheter.

Continuous epidural: With 20G catheter introduced with 18G needle through the intervertebral spaces (T6 - T8), up to the extradural space and here directed upwards for 4 cm to 5 cm.

Injection of isobaric bupivacaine through the catheter in two 10 ml boluses, 3 min apart, effective for 70 min. Subsequent injection of further boluses of 10 ml for each additional hour.

The goal is anesthetic coverage up to C3 (at the height of clavicle) in VLS to reach the roots of the phrenic nerve, i.e. the diaphragm, without motor block, but only sensation.

Single-shot spine: with 25G needle introduced subarachnoid through the L1-L2 space and injection of 5 mg to10 mg of isobaric bupivacaine.

When saddle anesthesia is required, through this spinal needle, a minimal amount of hyperbaric bupivacaine is used.

Simple spinal anesthesia

Single shot spinal:

Directions: patients of all ages, surgery <60 min.

Puncture with needle 25/27G in the intervertebral space T9-T11; 15 mg to 20 mg isobaric bupivacaine introduced into the subarachnoid space with anesthetic effect up to C3-C4 (at the level of clavicle).

Continuous spinal (subarachnoid)

Directions: patients >60 years,

Technique: 24G catheter introduced *via* 21G needle through the lower thoracic intervertebral spaces (T9-T11), and directed upward.

Introduction into the catheter of isobaric bupivacaine in close microboluses every 3 min, from 2 mg to 5 mg up to a maximum of 12.5 mg, effective for 90 min, to be repeated in doses up to 4 mg every hour.

The anesthetic in laparoscopic surgery, must reach C3-C4 (clavicle) for the sensory block of the phrenic nerve (diaphragm).

Simple epidural anesthesia

Directions: Particular conditions of sub-umbilical surgery and excavation.

Technique: same procedure for introducing the catheter into the vertebral specs at height L1-2 with the use of ropivacaine.

Problems: Obesity, senile arthrosis, agitation of the patient (resorting to sedatives), pain due to puncture of the roots (when the needle is inserted out of necessity in a paramedian position).

Complication: Hemorrhage, liquorrhea (post-operative headache).

Surgical Technique

Laparoscopic surgery

Position, trocars, pneumoperitoneum, introduction of the optics and exploration of the cavity, operation execution, opening and closing of the incision port, possible drainages, removal of the trocars.

The patient in supine position. Partially lateral decubitus used only for kidney surgery. The pneumoperitoneum induced through Verress needle, intracavity gas pressure was reached between 12 mm and 15 mm of mercury without ever causing patient unwanted reactions. Trocar position varied according to operating area, pathology, type of operation, size of the patient, according to traditional rules. The number of trocars varied from two to a maximum of four for sub-umbilical pathology and from three to a maximum of five for supra-umbilical one. At this point, the operating bed was given the most suitable extreme position to free the operating field from viscera unrelated to the operation that would limit the vision. The operating technique was traditional one for laparoscopic surgery, which by now has been consolidated through the guidelines and, in particular, for neoplasms. The operation lasted from a minimum of less than one hour for cholecystectomies; to a maximum of more than four hours for multiple operations (rectum surgery associated with hysterectomies, ileal or ureterovesical resections). Mini-laparotomy for surgical piece extraction was almost always suprapubic, according to Pfannenstiel. One or two thin drainage tubes were usually left in peritoneal cavity.

Results

The cases analysis allowed evaluating the possibility and effectiveness of neuraxial, spinal and epidural anesthesia, performed with specific techniques in laparoscopic surgery. In these cases, regardless of the intra-abdominal site of the operation, the gaseous distension of peritoneal cavity reaches the diaphragm which therefore must lose its sensitivity, but not mobility, necessary for spontaneous breathing. This aim is achieved by using diluted anesthetic (ropivacaine 0.2%, bupivacaine 0.125%, levobupivacaine 0.125%) introduced through epidural or spinal catheter or directly with spinal needle, which must reach the third cervical root in order to cover the superior origin of the phrenic nerve, exclusively blocking its sensory fibers. Verification of the metamer reached is obtained by noting the loss of skin sensitivity up to the level of the supraclavicular fossa. Of 84 neuraxial anesthesia performed, 82 were successful instead 2 cases was converted in GA: 1 for respiratory paralysis and 1 for insufficient analgesia. In 8 colectomies and 1 cholecystectomy it has been required other sedation drugs during the operation (Table 7).

Pain requiring analgesic therapy and one presented transient mental confusion. However, in the majority of the patients, in 58% of a preventive nature, painkillers were administered intravenously or peridurally through the catheter (Table 8).

Table 1: Neuraxial anesthesia. Case 1/1/19 - 30/6/20: 84 cases.

Total cases 84
M 42 - F 42
Average age 62.3 (25-89 years)
VLS 84
K 20 (23.8%)
Colon VLS 41
VLS gallbladder 32
Other VLS 11

Table 2: VLS surgery: 84 cases.

VLS surgery: 84 cases
• Colic resections 41 (dx7, sn 34 - K 17, MD 24)
• Cholecystectomy 32
• Nephrectomy for K 2
• Hysterectomy 1
• Annessectomy and Hysteroannessiectomy 3 (K 1, cyst 2)
• Acute appendicitis 2
• Bilateral inguinal hernia VLS 3

Table 3: Operated Pathology (84 cases).

Flogistics	55/84	65.4
Neoplasty	20/84	23.8
Other	9/84	10.7

Table 4-5: Anesthesia (ASA 1, 15 (17.8%) - ASA 2, 49 (58.6%) - ASA3, 20 (23.8%)).

	VL colon	VL gallbladder	VL other	Total
Spinal	4	31	1	36
Peridural	4	-	-	4
Spino-peri	33	1	-	34
Total	41	32	1	74

Table 6: Duration of intervention.

	n. Cases	Total Hours
1 h	19	19
1.30 h	21	31.5
2 h	25	50
2.30 h	16	42.5
Over	3	10
Total	84	153

Table 7: Intraoperative sedation.

Standard intra-operative sedation (midazolam)	100% of cases
Additional intra-operative drugs (fentanest, Ketamine, Ketadex)	10% of cases

Table 8: Drugs used.

Drugs used	**Cases**
Ketorolac EV	37
Tramadol EV	2
Fentanest (epidural elastomer)	15
No drugs	30

From the surgical point of view, it should be noted that in all the 84 cases operated laparoscopy, the muscular relaxation of the abdominal wall was complete and without interruptions, which is not always the case in long lasting general anesthesia. This allowed rapid interventions in most cases with excellent technique and minimal blood loss: of 84 cases, only four needed one or two post-operative blood transfusions, being operations for extensive neoplasms in patients in anemic condition. The low number of surgical complications observed (two fistulas on digestive anastomosis, spontaneously healed, and a ureteral fistula in an infiltrating bilateral

Table 9: Anesthetic compliance.

Intraoperative
- Headache 2 cases
- Respiratory paralysis (conversion to GA) 1
- Insufficient analgesia (conversion to GA) 1
Postoperative
- Abdominal pain (analgesic therapy) 6 cases
- Mental confusion (infusion therapy) 1
Surgical
- Anastomotic fistula 2(spontaneous healing)
- Left urethral fistula 1(VLS reoperation)

ovarian carcinoma) confirms the favorable operating conditions determined by neuraxial anesthesia (Table 9).

As for the post-operative, it should be emphasized that no patient has complained of complications related to the spinal puncture. Furthermore, despite the majority being classified ASA 2 and 3, in no case was post-operative respiratory assistance in intensive care necessary, with benefit for the sick and lower hospital costs.

Discussion

Abdominal surgery is generally performed with open abdomen and under GA. In the last twenty years, the number of centers that have practiced this surgery in laparoscopy has increased. However, as far as anesthesia is concerned, the choice has always fallen on narcosis by intubation (GA). Cases of open major abdominal surgery under neuraxial anesthesia have been collected in a few centers, but none of the series was laparoscopic. Three series of traditional open abdominal surgery with spinal anesthesia with good results should be mentioned. This type of anesthesia allowed the operation of ASA 3 and 4 patients with good survival who were considered ineligible or high risk for GA: in order of publication, Kumar et al. Of the University of Middlesbrough (UK) in 2008, Ellakany from University of Alexandria in Egypt in 2014, and Spannella from IRCA of Ancona in 2020.

Also in our experience, there is a series of oncological and non-oncological patients, who underwent open abdominal surgery under spinal/epidural anesthesia with excellent results, who are not included in the present work.

Kumar [23] reports 68 colorectal cancers, plus another 8 elective and 13 emergency operations, all open surgery, except for the gallbladder in laparoscopy, classified 31 ASA 4 and the other ASA 3, subjected to spinal anesthesia with hyperbaric bupivacaine and fentanyl between D6 and D8, followed by implantation in vertebral space of a microcatheter for intermittent postoperative injection of hyperbaric bupivacaine. In one case was there a need for conversion to GA (cardiorespiratory failure). During the operation, hypotension was recorded in 14% cases. In the post-operative period, morphine was used systematically and there was nausea in 14%, vomiting in 7.9%, headache in 5.6%, and itching in 5.6%.

Ellakany [10] reports 60 cases of open surgery, 30 operated under spinal anesthesia (TSCA) and 30 under GA for gastric and colic neoplasms. Spinal anesthesia was performed with introduction of hyperbaric bupivacaine and fentanyl citrate in ASA 2 and 3 patients and resulted in transient minor complications (2 peripheral paraesthesia, 6 anxiety, 6 hypotension with bradycardia). However, it also produced shorter ICU hospitalization, improved postoperative pain resolution, and greater patient satisfaction.

Spannella et al. [11] describe the first consistent Italian experience of spinal anesthesia in 90 cases of open major abdominal surgery in the elderly, medium of age 84 years. This is a retrospective study on ASA 3 patients to whom TSCA was performed with a catheter 24 introduced through the space between T6 and T7 and between T10 and 11 with hyperbaric bupivacaine or levobupivacaine plus fentanyl with subsequent refills during surgery and for the following 72 postoperative hours. No spinal complications were observed, but cardiac complications occurred in 15.6%, pulmonary complications in 13.3%, surgical complications in 13.3%, delusions in 14.4%, and hospital mortality of five cases equal to 5.6%. One case required conversion to GA. Our experience has some similarities with these previous and also relevant differences (Table 6, 10).

First of all, 84 cases underwent to laparoscopic surgery. Consequently, in order to sustain the pneumoperitoneum, the neuraxial anesthesia was necessarily extended up to the third cervical metamer to block the sensitivity of the diaphragm without changing its mobility. In previous experiences, only laparoscopic cholecystectomies have been performed.

Conclusions

At the moment, similar case histories are not available in the literature, almost as if the neuraxial anesthesia was used only in open surgery, apart from cholecystectomy. These results obtained

Table 10: Spinal anesthesia in abdominal surgery.

AA Year/ country	Operated cases	ASA	Anesthesia technique	Spinal drugs	Conversion to AG	Mortality cases	Complications post-top cases5
KUMAR 2008 UK	89 Open	3-4	Puncture T6-7-8 + catheter	Hyperbaric Bupivacaine + fentanyl	1 (respiratory insufficiency)	?	Nausea 14% headache5.6% vomiting 7.9% Itching 5.6%
ELLAKANY 2014 UK	30 (+30) Open	2-3	Puncture T9-10	Hyperbaric Bupivacaine + fentanyl	0	?	Paresthesia 2 Anxiety 6 Hypotension and bradycardia 6
SPANELLA 2020 ITA	90 Open	3	Puncture T6-7 T10-11 + catheter	Hyperbaric Bupivacaine + fentanyl	1	6 (5.6%)	Cardiac 16.6% Lung 13.3% Surgical 13.3% Delirium 14.4%
SANTORO 2020 ITA	84 VLS	1-2-3-	Puncture L1-2 Puncture L1-2 + catheter T6-7-8	Hypobaric Bupivacaine (+ midazolam)	2 (obesity) (respiratory insufficiency)	1 (1.2%) for postoperative cardiac arrest	Headache 2 Pain add 6 Delirium 1 Fistulas 3
Total	299				3	7	

in our experience in laparoscopic surgery, practically free from complications related to neuraxial anesthesia, are added to those already known for open abdominal surgery.

Another peculiarity in our series concerns the use of drugs, the systematic use of midazolam by neuraxial route for pre- and intra-operative sedation and the little or no use of painkillers in the postoperative period, unless the patient specifically needs or requests.

Finally, as regards the drugs used by direct puncture or through the anesthetic catheter, where in the other series was been systematically used the hyperbaric bupivacaine associated with fentanyl, in our series was used only isobaric bupivacaine or ropivacaine.

Conversion from spinal anesthesia to GA is well known, but it is rare and is generally due to respiratory insufficiency and also represents 1% in the collective series of table 10 with three cases out of 299 neuraxial anesthesia. Postoperative mortality is not related to spinal anesthesia, but to the prevalence of the pathology already known before surgery. None of the patients in our series needed post-operative intensive care for mechanical ventilation, although most of them were ASA 2 and 3.

In conclusion, our experience and the analysis of the literature allow us to state that neuraxial anesthesia:

- allows us to perform any abdominal surgery by laparoscopy;
- allows us to operate patients of any age with important cardio-respiratory comorbidities;
- does not cause admissions to intensive care for mechanical ventilation, not even in ASA 3 (often deemed ineligible for general anesthesia);
- leads to a painless postoperative period with early rehabilitation and a short-term hospitalization;
- can cause postoperative complications that are not serious, well manageable pharmacologically;
- is generally very well accepted by patients;
- In the era of ERAS, represents an operation entirely in line with the needs of a rapid post-operative recovery and an early discharge;
- is safe and riskless for the anesthesiologist during COVID pandemia.
- Finally, for general laparoscopic surgery, spinal anesthesia has some significant advantages such as no manipulation of the airways, maintenance of spontaneous breathing, postoperative analgesia, and rarity of nausea and vomiting, rapid resumption of deambulation. At the moment the choice of anesthesia for laparoscopic surgery remains a debated topic and is concerned by the experience and specific expertise of the anesthetist.

References

1. Hellil SE, Sahile WA, Abdo RA, Wolde GD, Halil HM. The effect of isobaric and hyperbaric bupivicaine on maternal hemodynamic changes post spinal anesthesia for elective cesarean delivery: A prospective cohort study. PloS One. 2019;14(12):e0226030.
2. Alonso YE, Gilsanz RF, Gredilla DE, Martinez SB, Canser CE. Continuous spinal anaesthesia in obstetrics. Rev Esp Aanest Rean. 2011;58(3):161-6.
3. Fernandez GJ, Garcia VS, Gomez-Arnau JI. Combined subaracnoidal epidural technique for obstetric analgesia. Re Esp Anaest Reanim. 2000;47(5):207-15.
4. Gautham B, Tabdar S, Shrestha U. Comparison of Fentanyl and Dexmedetomidine as intrathecal adjuvants to spinal anaesthesia for abdominal hysterectomy. JNMA J Nepal med Assoc. 2018;56(213):848-55.
5. Imbelloni LE, Vieira EM, Gouveia MA, Cordeiro JA. Restricted dorsal spinal anaesthesia for ambulatory anorectal surgery. Rev Bras Anestesiology. 2004;54(6):774-80.
6. Corda Teixeira JS, Correia MJD, Haas A, Tralhao A. Continuous spinal anaesthesia for partial gastrectomy in an adult patients in an unrepaired tetralogy of Fallot. Cardiol Young. 2019;29(6):845-6.
7. Cotugno M, Dallaglio M, Cantadori L, Villani F, Martens D, Cantoni F, et al. Right open nephrectomy under combined spinal and peridural operative anaesthesia and analgesia: A new anesthetic approach in abdominal surgery. Arch It Urol Androl. 2020;91(4):267-8.
8. Hayashi K, Murata K, Naito A, Kagawa Y, Kawai K, Mori R, et al. A case of resection of obstructive colon cancer associated with aspiration pneumonia, under combined epidural-spinal anaesthesia. Gan Kagaku Ryoho. 2017;44(12):1970-2.
9. Ellakany MH, Abdelhamid SA. Segmental thoracic spinal has advantages over general anaesthesia for breast cancer surgery. Anaesth Essays Res. 2013;7(3):390-5.
10. Ellakany MH. Thoracic spinal anaesthesia is safe for patients undergoing abdominal cancer surgery. Anaesth Essays Res. 2014;8(2):223-8.
11. Spannella F, Giuliett F, Damiani E, Faloia L, Stronati M, Venezia A, et al. Thoracic continuous spinal anaesthesia for high-risk comorbid older patients undergoing major abdominal surgery: One year experience of an Italian geriatric hospital. Minerva Anestesiol. 2020;86(3):261-9.
12. Imbelloni LE. Spinal anaesthesia for laparoscopic cholecistectomy. Thoracic versus lumbar technique. Saudi J Anaesth. 2014;8(4):477-83.
13. Olonisakin RP, Sotunmbi PT, Afuwape OO, Ayandipo OO, Adigun TA. Regional anaesthetic technique for laparoscopic appendicectomy in Ibadan. African J Med Sci. 2014;43(3):219-23.
14. Erdem VM, Donmez T, Uzman S, Ferahman S, Hatipoglu E, Sunamak O. Spinal epidural block as an alternative to general anaesthesia for laparoscopic appendectomy: A prospective randomized clinical study. Videochir Inne Tech Maloinwazyjne. 2018;13(2):148-56.
15. Singh RK, Saini AM, Goel N, Bisht D, Seth A. Major laparoscopic surgery under general anaesthesia. Med J Armed Forces India. 2015;71(2):126-31.
16. Wang XX, Zhou Q, Pan DB, Deng HW, Zhou AG, Guo HJ, et al. Comparison of postoperative events between spinal anaesthesia and general anaesthesia in laparoscopic cholecistectomy: A systemic review and metanalysis of randomized controlled trials. Biomed Res Int. 2016;2016:9480539.
17. Bajwa SJ, Kulshrestha A. Anaesthesia for laparoscopic surgery: General versus regional anaesthaesia. J Minim Access Surg. 2016;12(1):4-9.
18. Tatulli F, Delcuratolo A, Caraglia A, Notarnicola A, Carbone FPN, Caputi A. Three trocar laparoscopic cholecistectomy under spinal anesthesia in a patients with asthma. Giorn Chir. 2018;39(3):188-90.
19. Bayrat K, Altintas Y. Comparing laparoscopic cholecistectomy in patients with chronic obstructive pulmonary disease under spinal anaesthesia and general anaesthesia. BMC Surg. 2018;18(1):65.
20. Gautam B, Baral B. Spinal anaesthesia for laparoscopic cholecistectomy in Parkinson disease. JNMA J Nepal Med Assoc. 2018;56(211):701-4.
21. Nava S, Rossignoli L, Tagariello V, Bertini L. Technical difficulties in epidural block and spinal bleeding complications. Minerva Anestesiol. 2001;67(12):881-6.
22. Kreppel D, Antoniadis G, Seeling W. Spinal hematoma: A literature survey with metanalisis of 613 patients. Neurosurg Rev. 2003;26(1):1-49.
23. Kumar CM, Corbet WA, Wilson RG. Spinal anaesthesia with microcatheter in high risk patients undergoing colorectal cancer and other major abdominal surgery. Surg Oncol. 2008;17(2):73-7.