

RECOMMENDATIONS

In patients undergoing laparoscopic cholecystectomy:

1. Intravenous ondansetron (4mg) is recommended as a routine premedication before spinal anaesthesia to reduce the incidence of hypotension, bradycardia, nausea and vomiting.
2. More studies are needed to evaluate effects of ondansetron premedication in patients undergoing surgeries other than LC under spinal anaesthesia.

REFERENCES

1. Fitzgerald JE, Fitzgerald LA, Maxwell-Armstrong CA, Brooks AJ. Recurrent gallstone ileus: time to change our surgery? *J Dig Dis.* 2009 May;10(2):149-51.
2. Csendes A, Burdiles P, Maluenda F, Diaz JC, Csendes P, Mitru N. Simultaneous bacteriologic assessment of bile from gallbladder and common bile duct in control subjects and patients with gallstones and common duct stones. *Arch Surg.* 1996 Apr;131(4):389-94.
3. Goodman AJ, Neoptolemos JP, Carr-Locke DL, Finlay DB, Fossard DP. Detection of gallstones after acute pancreatitis. *Gut.* 1985 Feb;26(2):125-32.
4. Beal JM. Historical perspective of gallstone disease. *Surg Gynecol Obstet.* 1984 Feb;158(2):181-9.
5. Dmitriev BI, Demidov VM, Vansovich VE, Burlaka PG. [Laparoscopic cholecystectomy in the treatment of cholelithiasis]. *Klin Khir.* 1997(9-10):103-4.
6. Mirizzi PL. [Functional disorders of the common bile duct; its discrimination using operative cholangiography]. *Bol Trab Acad Argent Cir.* 1949 Sep 14;33(20):590-611.
7. Davis CJ. A history of endoscopic surgery. *Surg Laparosc Endosc.* 1992 Mar;2(1):16-23.
8. Kaiser AM, Corman ML. History of laparoscopy. *Surg Oncol Clin N Am.* 2001 Jul;10(3):483-92.
9. NIH Consensus conference. Gallstones and laparoscopic cholecystectomy. *JAMA.* 1993 Feb 24;269(8):1018-24.
10. Slim K, Pezet D, Stencl J, Jr., Lechner C, Le Roux S, Lointier P, et al. Laparoscopic cholecystectomy: an original three-trocar technique. *World J Surg.* 1995 May-Jun;19(3):394-7.
11. Cala Z. Laparoscopic cholecystectomy: an original three-trocar technique. *World J Surg.* 1996 Jan;20(1):117-8.
12. Cervantes J, Rojas G, Anton J. Changes in gallbladder surgery: comparative study 4 years before and 4 years after laparoscopic cholecystectomy. *World J Surg.* 1997 Feb;21(2):201-4.
13. Lomanto D, Cheah WK, So JB, Goh PM. Robotically assisted laparoscopic cholecystectomy: a pilot study. *Arch Surg.* 2001 Oct;136(10):1106-8.
14. Malik A, Mellinger JD, Hazey JW, Dunkin BJ, MacFadyen BV, Jr. Endoluminal and transluminal surgery: current status and future possibilities. *Surg Endosc.* 2006 Aug;20(8):1179-92.
15. Chalkoo M, Ahangar S, Durrani AM, Chalkoo S, Shah MJ, Bashir MI. Mini-lap cholecystectomy: modifications and innovations in technique. *Int J Surg.* 2010;8(2):112-7.
16. Akbulut Z, Canda AE, Cimen HI, Atmaca AF, Korukluoglu B, Balbay MD. Two procedures at the same robotic session: robot-assisted laparoscopic radical prostatectomy and cholecystectomy. *Surg Laparosc Endosc Percutan Tech.* 2011 Feb;21(1):e34-5.

17. Gurusamy KS, Samraj K, Fusai G, Davidson BR. Robot assistant versus human or another robot assistant in patients undergoing laparoscopic cholecystectomy. *Cochrane Database Syst Rev.* 2012;9:CD006578.
18. Ayloo S, Roh Y, Choudhury N. Laparoscopic versus robot-assisted cholecystectomy: a retrospective cohort study. *Int J Surg.* 2014 Oct;12(10):1077-81.
19. Heemskerk J, Zandbergen HR, Keet SW, Martijnse I, van Montfort G, Peters RJ, et al. Relax, it's just laparoscopy! A prospective randomized trial on heart rate variability of the surgeon in robot-assisted versus conventional laparoscopic cholecystectomy. *Dig Surg.* 2014;31(3):225-32.
20. Cunningham AJ. Anesthetic implications of laparoscopic surgery. *The Yale journal of biology and medicine.* [Comparative Study Review]. 1998 Nov-Dec;71(6):551-78.
21. Glavic Z, Begic L, Simlesa D, Rukavina A. Treatment of acute cholecystitis. A comparison of open vs laparoscopic cholecystectomy. *Surgical endoscopy.* [Comparative Study]. 2001 Apr;15(4):398-401.
22. Ali A, Chawla T, Jamal A. Ambulatory laparoscopic cholecystectomy: Is it safe and cost effective? *Journal of minimal access surgery.* 2009 Jan;5(1):8-13.
23. Chauhan A, Mehrotra M, Bhatia PK, Baj B, Gupta AK. Day care laparoscopic cholecystectomy: a feasibility study in a public health service hospital in a developing country. *World journal of surgery.* 2006 Sep;30(9):1690-5; discussion 6-7.
24. Topal B, Peeters G, Verbert A, Penninckx F. Outpatient laparoscopic cholecystectomy: clinical pathway implementation is efficient and cost effective and increases hospital bed capacity. *Surgical endoscopy.* 2007 Jul;21(7):1142-6.
25. de George MA, Rangel M, Noda RW, Kondo W. Laparoscopic transumbilical cholecystectomy: surgical technique. *JLS : Journal of the Society of Laparoendoscopic Surgeons / Society of Laparoendoscopic Surgeons.* 2009 Oct-Dec;13(4):536-41.
26. Dunning K, Kohli H. Transumbilical laparoscopic cholecystectomy: a novel technique. *Arch Surg.* 2009 Oct;144(10):957-60.
27. Cuschieri A, Dubois F, Mouiel J, Mouret P, Becker H, Buess G, et al. The European experience with laparoscopic cholecystectomy. *Am J Surg.* 1991 Mar;161(3):385-7.
28. Zucker KA, Bailey RW, Gadacz TR, Imbembo AL. Laparoscopic guided cholecystectomy. *Am J Surg.* 1991 Jan;161(1):36-42; discussion -4.
29. Minutolo V, Licciardello A, Arena M, Nicosia A, Di Stefano B, Cali G, et al. Laparoscopic cholecystectomy in the treatment of acute cholecystitis: comparison of outcomes and costs between early and delayed cholecystectomy. *Eur Rev Med Pharmacol Sci.* 2014 Dec;18(2 Suppl):40-6.
30. Liu TH, Consorti ET, Mercer DW. Laparoscopic cholecystectomy for acute cholecystitis: technical considerations and outcome. *Semin Laparosc Surg.* 2002 Mar;9(1):24-31.
31. Lien HH, Huang CC, Liu JS, Shi MY, Chen DF, Wang NY, et al. System approach to prevent common bile duct injury and enhance performance of laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech.* 2007 Jun;17(3):164-70.

32. Kitano S, Matsumoto T, Aramaki M, Kawano K. Laparoscopic cholecystectomy for acute cholecystitis. *J Hepatobiliary Pancreat Surg.* 2002;9(5):534-7.
33. Cheng Y, Leng J, Tan J, Chen K, Dong J. Proper surgical technique approved for early laparoscopic cholecystectomy for non-critically ill elderly patients with acute cholecystitis. *Hepatogastroenterology.* 2013 Jun;60(124):688-91.
34. Raeder JC, Mjaland O, Aasbo V, Groggaard B, Buanes T. Desflurane versus propofol maintenance for outpatient laparoscopic cholecystectomy. *Acta Anaesthesiol Scand.* 1998 Jan;42(1):106-10.
35. Power I, Barratt S. Analgesic agents for the postoperative period. Nonopioids. *Surg Clin North Am.* 1999 Apr;79(2):275-95.
36. Ding Y, Fredman B, White PF. Use of mivacurium during laparoscopic surgery: effect of reversal drugs on postoperative recovery. *Anesth Analg.* 1994 Mar;78(3):450-4.
37. Hovorka J, Korttila K, Nelskyla K, Soikkeli A, Sarvela J, Paatero H, et al. Reversal of neuromuscular blockade with neostigmine has no effect on the incidence or severity of postoperative nausea and vomiting. *Anesth Analg.* 1997 Dec;85(6):1359-61.
38. Kopman AF, Yee PS, Neuman GG. Relationship of the train-of-four fade ratio to clinical signs and symptoms of residual paralysis in awake volunteers. *Anesthesiology.* 1997 Apr;86(4):765-71.
39. Maltby JR, Beriault MT, Watson NC, Liepert D, Fick GH. The LMA-ProSeal is an effective alternative to tracheal intubation for laparoscopic cholecystectomy. *Can J Anaesth.* 2002 Oct;49(8):857-62.
40. Verghese C, Brimacombe JR. Survey of laryngeal mask airway usage in 11,910 patients: safety and efficacy for conventional and nonconventional usage. *Anesth Analg.* 1996 Jan;82(1):129-33.
41. Salihoglu Z, Demirogluk S, Dikmen Y. Respiratory mechanics in morbid obese patients with chronic obstructive pulmonary disease and hypertension during pneumoperitoneum. *Eur J Anaesthesiol.* 2003 Aug;20(8):658-61.
42. Imbelloni LE. Spinal anesthesia for laparoscopic cholecystectomy: Thoracic vs. Lumbar Technique. *Saudi J Anaesth.* 2014 Oct;8(4):477-83.
43. Chuang MC, Duggan LV, van Heest RD, MacLeod W. Laparoscopic cholecystectomy under spinal anesthesia in a patient with limb-girdle muscular dystrophy. *Can J Anaesth.* 2013 Dec;60(12):1276-7.
44. Ciofolo MJ, Clergue F, Seebacher J, Lefebvre G, Viars P. Ventilatory effects of laparoscopy under epidural anesthesia. *Anesth Analg.* 1990 Apr;70(4):357-61.
45. Collins LM, Vaghadia H. Regional anesthesia for laparoscopy. *Anesthesiol Clin North America.* 2001 Mar;19(1):43-55.
46. Murali Krishna T, Panda NB, Batra YK, Rajeev S. Combination of low doses of intrathecal ketamine and midazolam with bupivacaine improves postoperative analgesia in orthopaedic surgery. *Eur J Anaesthesiol.* 2008 Apr;25(4):299-306.
47. Mhuircheartaigh RJN, Moore RA, McQuay HJ. Analysis of individual patient data from clinical trials: epidural morphine for postoperative pain. *British Journal of Anaesthesia.* 2009 December 1, 2009;103(6):874-81.

48. FOGARTY DJ, CARABINE UA, MILLIGAN KR. COMPARISON OF THE ANALGESIC EFFECTS OF INTRATHECAL CLONIDINE AND INTRATHECAL MORPHINE AFTER SPINAL ANAESTHESIA IN PATIENTS UNDERGOING TOTAL HIP REPLACEMENT. *British Journal of Anaesthesia*. 1993 November 1, 1993;71(5):661-4.
49. Arcioni R Fau - Palmisani S, Palmisani S Fau - Tigano S, Tigano S Fau - Santorsola C, Santorsola C Fau - Sauli V, Sauli V Fau - Romano S, Romano S Fau - Mercieri M, et al. Combined intrathecal and epidural magnesium sulfate supplementation of spinal anesthesia to reduce post-operative analgesic requirements: a prospective, randomized, double-blind, controlled trial in patients undergoing major orthopedic surgery. 20070323 DCOM-20070703(0001-5172 (Print)).
50. Bromage PR. Problems with combined spinal and epidural anesthesia. *Reg Anesth Pain Med*. 1999 Mar-Apr;24(2):191.
51. Lennox PH, Vaghadia H, Henderson C, Martin L, Mitchell GW. Small-dose selective spinal anesthesia for short-duration outpatient laparoscopy: recovery characteristics compared with desflurane anesthesia. *Anesth Analg*. 2002 Feb;94(2):346-50, table of contents.
52. Bessa SS, Katri KM, Abdel-Salam WN, El-Kayal el SA, Tawfik TA. Spinal versus general anesthesia for day-case laparoscopic cholecystectomy: a prospective randomized study. *J Laparoendosc Adv Surg Tech A*. 2012 Jul-Aug;22(6):550-5.
53. Sun P, Jia Y. Comments on "Laparoscopic cholecystectomy under spinal versus general anesthesia: a prospective, randomized study"--can you really have the conclusion? *J Laparoendosc Adv Surg Tech A*. 2011 Apr;21(3):259.
54. Imbelloni LE, Fornasari M, Fialho JC, Sant'Anna R, Cordeiro JA. General anesthesia versus spinal anesthesia for laparoscopic cholecystectomy. *Rev Bras Anesthesiol*. 2010 May-Jun;60(3):217-27.
55. Luchette FA. Commentary on "Spinal versus general anesthesia for day-case laparoscopic cholecystectomy: a prospective randomized study". *J Laparoendosc Adv Surg Tech A*. 2012 Jul-Aug;22(6):556.
56. Sinha R, Gurwara AK, Gupta SC. Laparoscopic cholecystectomy under spinal anesthesia: a study of 3492 patients. *J Laparoendosc Adv Surg Tech A*. 2009 Jun;19(3):323-7.
57. Kar M, Kar JK, Debnath B. Experience of laparoscopic cholecystectomy under spinal anesthesia with low-pressure pneumoperitoneum--prospective study of 300 cases. *Saudi J Gastroenterol*. 2011 May-Jun;17(3):203-7.
58. Tang B, Cuschieri A. Conversions during laparoscopic cholecystectomy: risk factors and effects on patient outcome. *Journal of gastrointestinal surgery : official journal of the Society for Surgery of the Alimentary Tract*. [Review]. 2006 Jul-Aug;10(7):1081-91.
59. Struthers AD, Cuschieri A. Cardiovascular consequences of laparoscopic surgery. *Lancet*. 1998 Aug 15;352(9127):568-70.
60. Gannedahl P, Odeberg S, Brodin LA, Sollevi A. Effects of posture and pneumoperitoneum during anaesthesia on the indices of left ventricular filling. *Acta Anaesthesiol Scand*. 1996 Feb;40(2):160-6.

61. Lentschener C, Axler O, Fernandez H, Megarbane B, Billard V, Fouqueray B, et al. Haemodynamic changes and vasopressin release are not consistently associated with carbon dioxide pneumoperitoneum in humans. *Acta Anaesthesiol Scand*. 2001 May;45(5):527-35.
62. Torrielli R, Cesarini M, Winnock S, Cabiro C, Mene JM. [Hemodynamic changes during celioscopy: a study carried out using thoracic electric bioimpedance]. *Can J Anaesth*. 1990 Jan;37(1):46-51.
63. Joris JL, Chiche JD, Canivet JL, Jacquet NJ, Legros JJ, Lamy ML. Hemodynamic changes induced by laparoscopy and their endocrine correlates: effects of clonidine. *J Am Coll Cardiol*. 1998 Nov;32(5):1389-96.
64. Kashtan J, Green JF, Parsons EQ, Holcroft JW. Hemodynamic effect of increased abdominal pressure. *J Surg Res*. 1981 Mar;30(3):249-55.
65. Dorsay DA, Greene FL, Baysinger CL. Hemodynamic changes during laparoscopic cholecystectomy monitored with transesophageal echocardiography. *Surg Endosc*. 1995 Feb;9(2):128-33; discussion 33-4.
66. Hirvonen EA, Poikolainen EO, Paakkonen ME, Nuutinen LS. The adverse hemodynamic effects of anesthesia, head-up tilt, and carbon dioxide pneumoperitoneum during laparoscopic cholecystectomy. *Surg Endosc*. 2000 Mar;14(3):272-7.
67. Harris SN, Ballantyne GH, Luther MA, Perrino AC, Jr. Alterations of cardiovascular performance during laparoscopic colectomy: a combined hemodynamic and echocardiographic analysis. *Anesth Analg*. 1996 Sep;83(3):482-7.
68. Prior DL, Sprung J, Thomas JD, Whalley DG, Bourke DL. Echocardiographic and hemodynamic evaluation of cardiovascular performance during laparoscopy of morbidly obese patients. *Obes Surg*. 2003 Oct;13(5):761-7.
69. Gerasimov GF, Zabarskii LT. [State of the cardiovascular and respiratory systems in laparoscopy]. *Klin Med (Mosk)*. 1977 Oct;55(10):68-72.
70. Schulze S, Lyng KM, Bugge K, Perner A, Bendtsen A, Thorup J, et al. Cardiovascular and respiratory changes and convalescence in laparoscopic colonic surgery: comparison between carbon dioxide pneumoperitoneum and gasless laparoscopy. *Arch Surg*. 1999 Oct;134(10):1112-8.
71. Lip H, Delhaas E. Cardiovascular collapse during laparoscopy. *Am J Obstet Gynecol*. 1990 Mar;162(3):873.
72. Nyarwaya JB, Mazoit JX, Samii K. Are pulse oximetry and end-tidal carbon dioxide tension monitoring reliable during laparoscopic surgery? *Anaesthesia*. 1994 Sep;49(9):775-8.
73. Baraka A, Jabbour S, Hammoud R, Aouad M, Najjar F, Khoury G, et al. End-tidal carbon dioxide tension during laparoscopic cholecystectomy. Correlation with the baseline value prior to carbon dioxide insufflation. *Anaesthesia*. 1994 Apr;49(4):304-6.
74. Lister DR, Rudston-Brown B, Warriner CB, McEwen J, Chan M, Walley KR. Carbon dioxide absorption is not linearly related to intraperitoneal carbon dioxide insufflation pressure in pigs. *Anesthesiology*. 1994 Jan;80(1):129-36.
75. Wahba RW, Mamazza J. Ventilatory requirements during laparoscopic cholecystectomy. *Can J Anaesth*. 1993 Mar;40(3):206-10.

76. Bures E, Fusciardi J, Lanquetot H, Dhoste K, Richer JP, Lacoste L. Ventilatory effects of laparoscopic cholecystectomy. *Acta Anaesthesiol Scand.* 1996 May;40(5):566-73.
77. Fitzgerald SD, Andrus CH, Baudendistel LJ, Dahms TE, Kaminski DL. Hypercarbia during carbon dioxide pneumoperitoneum. *Am J Surg.* 1992 Jan;163(1):186-90.
78. Wulkan ML, Vasudevan SA. Is end-tidal CO₂ an accurate measure of arterial CO₂ during laparoscopic procedures in children and neonates with cyanotic congenital heart disease? *J Pediatr Surg.* 2001 Aug;36(8):1234-6.
79. Fuentes S, Cano I, Lopez M, Garcia A, Morante R, Moreno C, et al. [Cardiovascular and respiratory changes during laparoscopy in neonates and infants]. *Cir Pediatr.* 2012 Jul;25(3):126-8.
80. O'Malley C, Cunningham AJ. Physiologic changes during laparoscopy. *Anesthesiol Clin North America.* 2001 Mar;19(1):1-19.
81. Lamvu G, Zolnoun D, Boggess J, Steege JF. Obesity: physiologic changes and challenges during laparoscopy. *Am J Obstet Gynecol.* 2004 Aug;191(2):669-74.
82. Kovac AL. Prevention and treatment of postoperative nausea and vomiting. *Drugs.* [Review]. 2000 Feb;59(2):213-43.
83. van den Bosch JE, Kalkman CJ, Vergouwe Y, Van Klei WA, Bonsel GJ, Grobbee DE, et al. Assessing the applicability of scoring systems for predicting postoperative nausea and vomiting. *Anaesthesia.* 2005 Apr;60(4):323-31.
84. Eberhart LH, Geldner G, Kranke P, Morin AM, Schuffelen A, Treiber H, et al. The development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients. *Anesth Analg.* 2004 Dec;99(6):1630-7, table of contents.
85. Bourdaud N, Devys JM, Bientz J, Lejus C, Hebrard A, Tirel O, et al. Development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients: the VPOP score. *Paediatr Anaesth.* 2014 Sep;24(9):945-52.
86. Ziemann-Gimmel P, Goldfarb AA, Koppman J, Marema RT. Opioid-free total intravenous anaesthesia reduces postoperative nausea and vomiting in bariatric surgery beyond triple prophylaxis. *Br J Anaesth.* 2014 May;112(5):906-11.
87. Smith HS, Laufer A. Opioid induced nausea and vomiting. *Eur J Pharmacol.* 2014 Jan 5;722:67-78.
88. Retraction note: Prevention of postoperative nausea and vomiting with a small dose of propofol alone and combined with dexamethasone in patients undergoing laparoscopic cholecystectomy: a prospective, randomized, double-blind study. *Surg Endosc.* 2013 Jun;27(6):2251.
89. Retraction notice to "Low-dose propofol to prevent nausea and vomiting after laparoscopic surgery" [*Int J Gynecol Obstet* 106 (2009) 50-52]. *Int J Gynaecol Obstet.* 2013 Jan;120(1):108.
90. Akkurt BC, Temiz M, Inanoglu K, Aslan A, Turhanoglu S, Asfuroglu Z, et al. Comparison of recovery characteristics, postoperative nausea and vomiting, and gastrointestinal motility with total intravenous anesthesia with propofol versus inhalation anesthesia with desflurane for laparoscopic cholecystectomy: A randomized controlled study. *Curr Ther Res Clin Exp.* 2009 Apr;70(2):94-103.

91. Visser K, Hassink EA, Bonsel GJ, Moen J, Kalkman CJ. Randomized controlled trial of total intravenous anesthesia with propofol versus inhalation anesthesia with isoflurane-nitrous oxide: postoperative nausea with vomiting and economic analysis. *Anesthesiology*. 2001 Sep;95(3):616-26.
92. Grabowska-Gawel A, Porzych K, Piskunowicz G. [Risk factors and frequency of postoperative nausea and vomiting in patients operated under general anesthesia]. *Przeegl Lek*. 2006;63(2):72-6.
93. Maleck WH, Piper SN. Predictive models for postoperative nausea and vomiting. *Br J Anaesth*. 2002 Aug;89(2):339-40; author reply 40-2.
94. Rojas C, Slusher BS. Pharmacological mechanisms of 5-HT(3) and tachykinin NK(1) receptor antagonism to prevent chemotherapy-induced nausea and vomiting. *Eur J Pharmacol*. 2012 Jun 5;684(1-3):1-7.
95. Bhattacharjee DP, Dawn S, Nayak S, Roy PR, Acharya A, Dey R. A comparative study between palonosetron and granisetron to prevent postoperative nausea and vomiting after laparoscopic cholecystectomy. *J Anaesthesiol Clin Pharmacol*. 2010 Oct;26(4):480-3.
96. Wu SJ, Xiong XZ, Cheng TY, Lin YX, Cheng NS. Efficacy of ondansetron vs. metoclopramide in prophylaxis of postoperative nausea and vomiting after laparoscopic cholecystectomy: a systematic review and meta-analysis. *Hepatogastroenterology*. 2012 Oct;59(119):2064-74.
97. Antor MA, Uribe AA, Erminy-Falcon N, Werner JG, Candiotti KA, Pergolizzi JV, et al. The effect of transdermal scopolamine for the prevention of postoperative nausea and vomiting. *Front Pharmacol*. 2014;5:55.
98. Jimenez Fuertes M, Costa Navarro D. Outpatient laparoscopic cholecystectomy and pain control: A series of 100 cases. *Cir Esp*. 2014 Mar 11.
99. McMahan AJ, Baxter JN, Murray W, Imrie CW, Kenny G, O'Dwyer PJ. Helium pneumoperitoneum for laparoscopic cholecystectomy: ventilatory and blood gas changes. *Br J Surg*. 1994 Jul;81(7):1033-6.
100. Junghans T, Bohm B, Grundel K, Schwenk W. Effects of pneumoperitoneum with carbon dioxide, argon, or helium on hemodynamic and respiratory function. *Arch Surg*. 1997 Mar;132(3):272-8.
101. Andrus CH. Hemodynamic effects of argon pneumoperitoneum. *Surg Endosc*. 1994 Apr;8(4):322-3.
102. Roberts MW, Mathiesen KA, Ho HS, Wolfe BM. Cardiopulmonary responses to intravenous infusion of soluble and relatively insoluble gases. *Surg Endosc*. 1997 Apr;11(4):341-6.
103. McDermott JP, Regan MC, Page R, Stokes MA, Barry K, Moriarty DC, et al. Cardiorespiratory effects of laparoscopy with and without gas insufflation. *Arch Surg*. 1995 Sep;130(9):984-8.
104. Rademaker BM, Meyer DW, Bannenberg JJ, Klopper PJ, Kalkman CJ. Laparoscopy without pneumoperitoneum. Effects of abdominal wall retraction versus carbon dioxide insufflation on hemodynamics and gas exchange in pigs. *Surg Endosc*. 1995 Jul;9(7):797-801.

105. Jolobe OM. Randomized comparison of the neuroendocrine response to laparoscopic cholecystectomy using either the conventional or abdominal wall lift techniques. *Br J Surg.* 1997 Mar;84(3):426-7.
106. Bouvy ND, Marquet RL, Jeekel H, Bonjer HJ. Impact of gas(less) laparoscopy and laparotomy on peritoneal tumor growth and abdominal wall metastases. *Ann Surg.* 1996 Dec;224(6):694-700; discussion -1.
107. Barczynski M, Herman RM. A prospective randomized trial on comparison of low-pressure (LP) and standard-pressure (SP) pneumoperitoneum for laparoscopic cholecystectomy. *Surg Endosc.* 2003 Apr;17(4):533-8.
108. Sarli L, Costi R, Sansebastiano G, Trivelli M, Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy. *Br J Surg.* 2000 Sep;87(9):1161-5.
109. Novachkov V, Stamenov G, Kostov I. [Laparoscopy with low abdominal pressure]. *Akush Ginekol (Sofia).* 2003;42(5):20-1.
110. Staehr-Rye AK, Rasmussen LS, Rosenberg J, Juul P, Gatke MR. Optimized surgical space during low-pressure laparoscopy with deep neuromuscular blockade. *Dan Med J.* 2013 Feb;60(2):A4579.
111. Beqiri AI, Domi RQ, Sula HH, Zaimi EQ, Petrela EY. The combination of infiltrative bupivacaine with low-pressure laparoscopy reduces postcholecystectomy pain. A prospective randomized controlled study. *Saudi Med J.* 2012 Feb;33(2):134-8.
112. Bala D, Shields D, Shukri S. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy (*Br J Surg* 2000;87:1161-5). *Br J Surg.* 2001 Feb;88(2):315.
113. Pearce JM. Henry Gray's Anatomy. *Clin Anat.* 2009 Apr;22(3):291-5.
114. Putz R. The detailed functional anatomy of the ligaments of the vertebral column. *Ann Anat.* 1992 Feb;174(1):40-7.
115. Ellis H. Anatomy for anaesthetists. 5. The lumbar spine and sacrum. *Anaesthesia.* 1962 Apr;17:238-46.
116. Barson AJ. The vertebral level of termination of the spinal cord during normal and abnormal development. *J Anat.* 1970 May;106(Pt 3):489-97.
117. Bican O, Minagar A, Pruitt AA. The spinal cord: a review of functional neuroanatomy. *Neurol Clin.* 2013 Feb;31(1):1-18.
118. Hughes JT. The new neuroanatomy of the spinal cord. *Paraplegia.* 1989 Apr;27(2):90-8.
119. Bernards CM. Sophistry in medicine: lessons from the epidural space. *Reg Anesth Pain Med.* 2005 Jan-Feb;30(1):56-66.
120. Blomberg RG. Fibrous structures in the subarachnoid space: a study with spinaloscopy in autopsy subjects. *Anesth Analg.* 1995 May;80(5):875-9.
121. Parkinson D. Human spinal arachnoid septa, trabeculae, and "rogue strands". *Am J Anat.* 1991 Dec;192(4):498-509.
122. Sakura S. [Factors influencing the level of spinal anesthesia: (II). Patient characteristics and technique of injection]. *Masui.* 2000 Feb;49(2):150-8.

123. Brassier J. [Spinal anesthesia: a new technique of access to the intrathecal space]. *Cah Anesthesiol.* 1993;41(6):673-5.
124. Chardon F, Pasquier I. [Peridural and spinal anesthesia. Technique, supervision and complications]. *Soins Chir.* 1996 Dec(180):47-8.
125. Salinas FV, Sueda LA, Liu SS. Physiology of spinal anaesthesia and practical suggestions for successful spinal anaesthesia. *Best Pract Res Clin Anaesthesiol.* 2003 Sep;17(3):289-303.
126. Grossi P, Barbaglio C, Violini A, Allegri M, Thekla N. Regional anesthesia update. *Minerva Anesthesiol.* 2010 Apr 12.
127. Neal JM. Ultrasound-guided regional anesthesia and patient safety: An evidence-based analysis. *Reg Anesth Pain Med.* 2010 Mar-Apr;35(2 Suppl):S59-67.
128. Brodsky JB, Lemmens HJ. Update on local and regional anesthesia in obesity. *Acta Anaesthesiol Belg.* 2009;60(3):181-3.
129. Wulf H. [Spinal anesthesia--renaissance of an old technique]. *Anesthesiol Intensivmed Notfallmed Schmerzther.* 2010 Mar;45(3):174-5.
130. Rabinowitz A, Bourdet B, Minville V, Chassery C, Pianezza A, Colombani A, et al. The paramedian technique: a superior initial approach to continuous spinal anesthesia in the elderly. *Anesth Analg.* 2007 Dec;105(6):1855-7, table of contents.
131. Post C, Freedman J, Ramsay CH, Bonnevier A. Redistribution of lidocaine and bupivacaine after intrathecal injection in mice. *Anesthesiology.* 1985 Oct;63(4):410-7.
132. Boswell MV, Iacono RP, Guthkelch AN. Sites of action of subarachnoid lidocaine and tetracaine: observations with evoked potential monitoring during spinal cord stimulator implantation. *Reg Anesth.* 1992 Jan-Feb;17(1):37-42.
133. Urban BJ. Clinical observations suggesting a changing site of action during induction and recession of spinal and epidural anesthesia. *Anesthesiology.* 1973 Nov;39(5):496-503.
134. Solenkova AV, Safronov VA, Lubnin A, Shevelev IN, Konovalov NA. [Epidural anesthesia in surgical interventions on the spine and spinal cord. II. Effects of epidural anesthesia on somatosensory evoked potentials]. *Anesteziol Reanimatol.* 2000 Jul-Aug(4):32-8.
135. Fink BR. Mechanisms of differential axial blockade in epidural and subarachnoid anesthesia. *Anesthesiology.* 1989 May;70(5):851-8.
136. Fink BR, Cairns AM. Lack of size-related differential sensitivity to equilibrium conduction block among mammalian myelinated axons exposed to lidocaine. *Anesth Analg.* 1987 Oct;66(10):948-53.
137. Chamberlain DP, Chamberlain BD. Changes in the skin temperature of the trunk and their relationship to sympathetic blockade during spinal anesthesia. *Anesthesiology.* 1986 Aug;65(2):139-43.
138. Gentili M, Huu PC, Enel D, Hollande J, Bonnet F. Sedation depends on the level of sensory block induced by spinal anaesthesia. *Br J Anaesth.* 1998 Dec;81(6):970-1.
139. Ben-David B, Vaida S, Gaitini L. The influence of high spinal anesthesia on sensitivity to midazolam sedation. *Anesth Analg.* 1995 Sep;81(3):525-8.

140. Tverskoy M, Shagal M, Finger J, Kissin I. Subarachnoid bupivacaine blockade decreases midazolam and thiopental hypnotic requirements. *J Clin Anesth.* 1994 Nov-Dec;6(6):487-90.
141. Hodgson PS, Liu SS, Gras TW. Does epidural anesthesia have general anesthetic effects? A prospective, randomized, double-blind, placebo-controlled trial. *Anesthesiology.* 1999 Dec;91(6):1687-92.
142. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anesthesia. *Anesthesiology.* 1992 Jun;76(6):906-16.
143. Rodriguez J, Carceller J. [Cardiovascular changes in preganglionic sympathetic block during spinal anesthesia]. *Rev Esp Anestesiol Reanim.* 1994 Mar-Apr;41(2):117-20.
144. Shimosato S, Etsten BE. The role of the venous system in cardiocirculatory dynamics during spinal and epidural anesthesia in man. *Anesthesiology.* 1969 Jun;30(6):619-28.
145. Ward RJ, Bonica JJ, Freund FG, Akamatsu T, Danziger F, Engleson S. Epidural and subarachnoid anesthesia. Cardiovascular and respiratory effects. *JAMA.* 1965 Jan 25;191(4):275-8.
146. Kaimar P, Sanji N, Upadya M, Mohammed KR. A comparison of hypotension and bradycardia following spinal anesthesia in patients on calcium channel blockers and beta-blockers. *Indian J Pharmacol.* 2012 Mar;44(2):193-6.
147. Kyokong O, Charuluxananan S, Sriprajittichai P, Poomseetong T, Naksin P. The incidence and risk factors of hypotension and bradycardia associated with spinal anesthesia. *J Med Assoc Thai.* 2006 Sep;89 Suppl 3:S58-64.
148. Kashihara K. Roles of arterial baroreceptor reflex during bezold-jarisch reflex. *Curr Cardiol Rev.* 2009 Nov;5(4):263-7.
149. Chiladakis JA, Patsouras N, Manolis AS. The Bezold-Jarisch reflex in acute inferior myocardial infarction: clinical and sympathovagal spectral correlates. *Clin Cardiol.* 2003 Jul;26(7):323-8.
150. Ou CH, Tsou MY, Ting CK, Chiou CS, Chan KH, Tsai SK. Occurrence of the Bezold-Jarisch reflex during Cesarean section under spinal anesthesia--a case report. *Acta Anaesthesiol Taiwan.* 2004 Sep;42(3):175-8.
151. Amrouni K, Vernet B. [Spinal anesthesia and von Bezold-Jarisch reflex?]. *Ann Fr Anesth Reanim.* 1999 Apr;18(4):468-9.
152. Naumann CR, Zelig C, Napolitano PG, Ko CW. Nausea, vomiting, and heartburn in pregnancy: a prospective look at risk, treatment, and outcome. *J Matern Fetal Neonatal Med.* 2012 Aug;25(8):1488-93.
153. Wang M, Zhuo L, Wang Q, Shen MK, Yu YY, Yu JJ, et al. Efficacy of prophylactic intravenous ondansetron on the prevention of hypotension during cesarean delivery: a dose-dependent study. *Int J Clin Exp Med.* 2014;7(12):5210-6.
154. Marashi SM, Soltani-Omid S, Soltani Mohammadi S, Aghajani Y, Movafegh A. Comparing Two Different Doses of Intravenous Ondansetron With Placebo on Attenuation of Spinal-induced Hypotension and Shivering. *Anesth Pain Med.* 2014 May;4(2):e12055.
155. Downs AJ, Poonawala Y. Reduction in spinal-induced hypotension with ondansetron. *Int J Obstet Anesth.* 2012 Oct;21(4):380; author reply

156. Sahoo T, SenDasgupta C, Goswami A, Hazra A. Reduction in spinal-induced hypotension with ondansetron in parturients undergoing caesarean section: a double-blind randomised, placebo-controlled study. *Int J Obstet Anesth.* 2012 Jan;21(1):24-8.
157. Yamano M, Ito H, Kamato T, Miyata K. Characteristics of inhibitory effects of serotonin (5-HT)₃-receptor antagonists, YM060 and YM114 (KAE-393), on the von Bezold-Jarisch reflex induced by 2-Methyl-5-HT, veratridine and electrical stimulation of vagus nerves in anesthetized rats. *Jpn J Pharmacol.* 1995 Dec;69(4):351-6.
158. Rout CC, Rocke DA, Levin J, Gouws E, Reddy D. A reevaluation of the role of crystalloid preload in the prevention of hypotension associated with spinal anesthesia for elective cesarean section. *Anesthesiology.* 1993 Aug;79(2):262-9.
159. Marhofer P, Faryniak B, Oismuller C, Koinig H, Kapral S, Mayer N. Cardiovascular effects of 6% hetastarch and lactated Ringer's solution during spinal anesthesia. *Reg Anesth Pain Med.* 1999 Sep-Oct;24(5):399-404.
160. Butterworth JFt, Piccione W, Jr., Berrizbeitia LD, Dance G, Shemin RJ, Cohn LH. Augmentation of venous return by adrenergic agonists during spinal anesthesia. *Anesth Analg.* 1986 Jun;65(6):612-6.
161. Ward RJ, Kennedy WF, Bonica JJ, Martin WE, Tolas AG, Akamatsu T. Experimental evaluation of atropine and vasopressors for the treatment of hypotension of high subarachnoid anesthesia. *Anesth Analg.* 1966 Sep-Oct;45(5):621-9.
162. Lundberg J, Norgren L, Thomson D, Werner O. Hemodynamic effects of dopamine during thoracic epidural analgesia in man. *Anesthesiology.* 1987 May;66(5):641-6.
163. Tarkkila P, Isola J. A regression model for identifying patients at high risk of hypotension, bradycardia and nausea during spinal anesthesia. *Acta Anaesthesiol Scand.* 1992 Aug;36(6):554-8.
164. Arxer A, Novoa L, Vieito Amor M, Hernandez Iniesta J, Villalonga A. [Bradycardia-tachycardia syndrome during spinal anesthesia]. *Rev Esp Anestesiol Reanim.* 2003 Oct;50(8):414-7.
165. Hakumaki MO. Seventy years of the Bainbridge reflex. *Acta Physiol Scand.* 1987 Jun;130(2):177-85.
166. Crystal GJ, Salem MR. The Bainbridge and the "reverse" Bainbridge reflexes: history, physiology, and clinical relevance. *Anesth Analg.* 2012 Mar;114(3):520-32.
167. Gauthier RA, Dyck B, Chung F, Romanelli J, Chapman KR. Respiratory interaction after spinal anesthesia and sedation with midazolam. *Anesthesiology.* 1992 Nov;77(5):909-14.
168. Sakura S, Saito Y, Kosaka Y. Effect of lumbar epidural anesthesia on ventilatory response to hypercapnia in young and elderly patients. *J Clin Anesth.* 1993 Mar-Apr;5(2):109-13.
169. Steinbrook RA, Concepcion M. Respiratory effects of spinal anesthesia: resting ventilation and single-breath CO₂ response. *Anesth Analg.* 1991 Feb;72(2):182-6.
170. Steinbrook RA. Respiratory effects of spinal anesthesia. *Int Anesthesiol Clin.* 1989 Spring;27(1):40-5.
171. Butterworth J. Physiology of spinal anesthesia: what are the implications for management? *Reg Anesth Pain Med.* 1998 Jul-Aug;23(4):370-3; discussion 84-7.

172. Carli F. Physiologic considerations of Enhanced Recovery After Surgery (ERAS) programs: implications of the stress response. *Can J Anaesth.* 2014 Dec 12.
173. Calvo-Soto P, Martinez-Contreras A, Hernandez BT, And FP, Vasquez C. Spinal-general anaesthesia decreases neuroendocrine stress response in laparoscopic cholecystectomy. *J Int Med Res.* 2012;40(2):657-65.
174. McCrae AF, Wildsmith JA. Prevention and treatment of hypotension during central neural block. *Br J Anaesth.* 1993 Jun;70(6):672-80.
175. Dahl JB, Schultz P, Anker-Moller E, Christensen EF, Staunstrup HG, Carlsson P. Spinal anaesthesia in young patients using a 29-gauge needle: technical considerations and an evaluation of postoperative complaints compared with general anaesthesia. *Br J Anaesth.* 1990 Feb;64(2):178-82.
176. Flaatten H, Thorsen T, Askeland B, Finne M, Rosland J, Hansen T, et al. Puncture technique and postural postdural puncture headache. A randomised, double-blind study comparing transverse and parallel puncture. *Acta Anaesthesiol Scand.* 1998 Nov;42(10):1209-14.
177. Baysinger CL. Accidental dural puncture and postdural puncture headache management. *Int Anesthesiol Clin.* 2014 Summer;52(3):18-39.
178. Kuczkowski KM. Postdural puncture headache after lumbar puncture: do the gauge and the design of a spinal needle matter? *Am J Emerg Med.* 2006 Oct;24(6):757.
179. Halpern S, Preston R. Postdural puncture headache and spinal needle design. Metaanalyses. *Anesthesiology.* 1994 Dec;81(6):1376-83.
180. Camann WR, Murray RS, Mushlin PS, Lambert DH. Effects of oral caffeine on postdural puncture headache. A double-blind, placebo-controlled trial. *Anesth Analg.* 1990 Feb;70(2):181-4.
181. Kane RE. Neurologic deficits following epidural or spinal anesthesia. *Anesth Analg.* 1981 Mar;60(3):150-61.
182. Hartung HJ, Luiz T. [Total spinal anesthesia. A complication of lumbar catheter peridural anesthesia for postoperative analgesia]. *Anaesthesist.* 1992;41(5):285-7.
183. Horlocker TT, McGregor DG, Matsushige DK, Schroeder DR, Besse JA. A retrospective review of 4767 consecutive spinal anesthetics: central nervous system complications. Perioperative Outcomes Group. *Anesth Analg.* 1997 Mar;84(3):578-84.
184. Lambert LA, Lambert DH, Strichartz GR. Irreversible conduction block in isolated nerve by high concentrations of local anesthetics. *Anesthesiology.* 1994 May;80(5):1082-93.
185. Rigler ML, Drasner K, Krejcie TC, Yelich SJ, Scholnick FT, DeFontes J, et al. Cauda equina syndrome after continuous spinal anesthesia. *Anesth Analg.* 1991 Mar;72(3):275-81.
186. Schneider MC, Hampl KF, Kaufmann M. Transient neurologic toxicity after subarachnoid anesthesia with hyperbaric 5% lidocaine. *Anesth Analg.* 1994 Sep;79(3):610.
187. Liguori GA, Zayas VM, Chisholm MF. Transient neurologic symptoms after spinal anesthesia with mepivacaine and lidocaine. *Anesthesiology.* 1998 Mar;88(3):619-23.
188. Bromage PR. Spinal opiate analgesia: its present role and future in pain relief. *Ann Chir Gynaecol.* 1984;73(3):183-9.

189. Flake ZA, Scalley RD, Bailey AG. Practical selection of antiemetics. *Am Fam Physician*. 2004 Mar 1;69(5):1169-74.
190. Hassessian H, Poulat P, Hamel E, Reader TA, Couture R. Spinal cord serotonin receptors in cardiovascular regulation and potentiation of the pressor response to intrathecal substance P after serotonin depletion. *Can J Physiol Pharmacol*. 1993 Jul;71(7):453-64.
191. Fouad K, Rank MM, Vavrek R, Murray KC, Sanelli L, Bennett DJ. Locomotion after spinal cord injury depends on constitutive activity in serotonin receptors. *J Neurophysiol*. 2010 Dec;104(6):2975-84.
192. Baumgarten HG. [Anatomy and physiology of the central serotonin system]. *Arzneimittelforschung*. 1981;Suppl 27:23-5.
193. Nadeev AD, Zharkikh IL, Avdonin PV, Goncharov NV. [Serotonin and its receptors in the cardiovascular system]. *Eksp Klin Farmakol*. 2014;77(5):32-7.
194. Bazarevitch G, Sadekov M, Tereschenko V, Devjataev A, Markarova L. Role of serotonin in the regulation of respiratory system function. *Acta Physiol Pol*. 1978 Mar-Apr;29(2):131-8.
195. Muth ER, Elkins AN. High dose ondansetron for reducing motion sickness in highly susceptible subjects. *Aviat Space Environ Med*. 2007 Jul;78(7):686-92.
196. Tyers MB. Pharmacology and preclinical antiemetic properties of ondansetron. *Semin Oncol*. 1992 Aug;19(4 Suppl 10):1-8.
197. Purgato M, Barbui C. What is the WHO essential medicines list? *Epidemiol Psychiatr Sci*. 2012 Dec;21(4):343-5.
198. Tyers MB, Bunce KT, Humphrey PP. Pharmacological and anti-emetic properties of ondansetron. *Eur J Cancer Clin Oncol*. 1989;25 Suppl 1:S15-9.
199. Christofaki M, Papaioannou A. Ondansetron: a review of pharmacokinetics and clinical experience in postoperative nausea and vomiting. *Expert Opin Drug Metab Toxicol*. 2014 Mar;10(3):437-44.
200. Quimby JM, Lake RC, Hansen RJ, Lunghofer PJ, Gustafson DL. Oral, subcutaneous, and intravenous pharmacokinetics of ondansetron in healthy cats. *J Vet Pharmacol Ther*. 2014 Aug;37(4):348-53.
201. Simpson KH, Hicks FM. Clinical pharmacokinetics of ondansetron. A review. *J Pharm Pharmacol*. 1996 Aug;48(8):774-81.
202. Miyashita M, Onda M, Ikeda K, Bando K, Hagiwara N, Tsuchiya Y, et al. [Effects of intravenous and oral administration of ondansetron hydrochloride on chemotherapy-induced nausea and vomiting in patients with esophageal cancer]. *Gan To Kagaku Ryoho*. 1999 Oct;26(11):1629-35.
203. Miyamoto Y, Yagi K, Teramachi M, Oomasa M, Tomiyama K. [Effect of ondansetron hydrochloride injection and tablet against nausea and vomiting in lung cancer patients receiving carboplatin]. *Gan To Kagaku Ryoho*. 1999 Jan;26(1):125-30.
204. Carlisle JB, Stevenson CA. Drugs for preventing postoperative nausea and vomiting. *Cochrane Database Syst Rev*. 2006(3):CD004125.
205. Abell TL, Adams KA, Boles RG, Bousvaros A, Chong SK, Fleisher DR, et al. Cyclic vomiting syndrome in adults. *Neurogastroenterol Motil*. 2008 Apr;20(4):269-84.

206. Freedman SB, Adler M, Seshadri R, Powell EC. Oral ondansetron for gastroenteritis in a pediatric emergency department. *N Engl J Med.* 2006 Apr 20;354(16):1698-705.
207. Finn AL. Toxicity and side effects of ondansetron. *Semin Oncol.* 1992 Aug;19(4 Suppl 10):53-60.
208. Gupta SD, Pal R, Sarkar A, Mukherjee S, Mitra K, Roy S, et al. Evaluation of Ondansetron-induced QT interval prolongation in the prophylaxis of postoperative emesis. *J Nat Sci Biol Med.* 2011 Jan;2(1):119-24.
209. Hafermann MJ, Namdar R, Seibold GE, Page RL, 2nd. Effect of intravenous ondansetron on QT interval prolongation in patients with cardiovascular disease and additional risk factors for torsades: a prospective, observational study. *Drug Healthc Patient Saf.* 2011;3:53-8.
210. Safavi M, Honarmand A, Negahban M, Attari M. Prophylactic effects of intrathecal Meperidine and intravenous Ondansetron on shivering in patients undergoing lower extremity orthopedic surgery under spinal anesthesia. *J Res Pharm Pract.* 2014 Jul;3(3):94-9.
211. Gu WJ, Liu JC. Ondansetron and shivering during cesarean delivery under combined spinal epidural anesthesia: a live issue. *Reg Anesth Pain Med.* 2013 May-Jun;38(3):252.
212. Shakya S, Chaturvedi A, Sah BP. Prophylactic low dose ketamine and ondansetron for prevention of shivering during spinal anaesthesia. *J Anaesthesiol Clin Pharmacol.* 2010 Oct;26(4):465-9.
213. Kelsaka E, Baris S, Karakaya D, Sarihasan B. Comparison of ondansetron and meperidine for prevention of shivering in patients undergoing spinal anesthesia. *Reg Anesth Pain Med.* 2006 Jan-Feb;31(1):40-5.
214. Demirhan A, Tekelioglu YU, Akkaya A, Ozlu T, Yildiz I, Bayir H, et al. Antiemetic effects of dexamethasone and ondansetron combination during cesarean sections under spinal anaesthesia. *Afr Health Sci.* 2013 Jun;13(2):475-82.
215. Jabalameli M, Honarmand A, Safavi M, Chitsaz M. Treatment of postoperative nausea and vomiting after spinal anesthesia for cesarean delivery: A randomized, double-blinded comparison of midazolam, ondansetron, and a combination. *Adv Biomed Res.* 2012;1:2.
216. Tan T, Ojo R, Immani S, Choroszczak P, Carey M. Reduction of severity of pruritus after elective caesarean section under spinal anaesthesia with subarachnoid morphine: a randomised comparison of prophylactic granisetron and ondansetron. *Int J Obstet Anesth.* 2010 Jan;19(1):56-60.
217. Kolm A, Ferraz AA, Modolo NS, Ferrari F, Ganem EM, Rodrigues Junior GR, et al. [Prevention of itching after spinal sufentanil: effects of droperidol, nalbuphine, ondansetron and the association of them.]. *Rev Bras Anesthesiol.* 2006 Feb;56(1):28-33.
218. Pernia A, Calderon E, Calderon Pla E, Torres LM. [Ondansetron in the treatment of the pruritus associated with the spinal infusion of opiates]. *Rev Esp Anesthesiol Reanim.* 2000 Nov;47(9):425-6.
219. Gordh T. [Indications and contraindications of spinal anesthesia]. *Sven Lakartidn.* 1953 Aug 7;50(32):1652-61.
220. Robak T. [Clinical pharmacology of ondansetron]. *Acta Haematol Pol.* 1993;24(2):103-13.

221. Diemunsch P, Apfel C, Gan TJ, Candiotti K, Philip BK, Chelly J, et al. Preventing postoperative nausea and vomiting: post hoc analysis of pooled data from two randomized active-controlled trials of aprepitant. *Curr Med Res Opin.* 2007 Oct;23(10):2559-65.
222. Ramsay MA. Measuring level of sedation in the intensive care unit. *JAMA.* 2000 Jul 26;284(4):441-2.
223. Celenza A, Rogers IR. Comparison of visual analogue and Likert scales in evaluation of an emergency department bedside teaching programme. *Emerg Med Australas.* 2011 Feb;23(1):68-75.
224. Sullivan GM, Artino AR, Jr. Analyzing and interpreting data from likert-type scales. *J Grad Med Educ.* 2013 Dec;5(4):541-2.
225. de Goede B, Klitsie PJ, Hagen SM, van Kempen BJ, Spronk S, Metselaar HJ, et al. Meta-analysis of laparoscopic versus open cholecystectomy for patients with liver cirrhosis and symptomatic cholelithiasis. *Br J Surg.* 2013 Jan;100(2):209-16.
226. Fajardo R, Valenzuela JI, Olaya SC, Quintero G, Carrasquilla G, Pinzon CE, et al. [Cost-effectiveness of laparoscopic versus open cholecystectomy]. *Biomedica.* 2011 Oct-Dec;31(4):514-24.
227. Paajanen H, Suuronen S, Nordstrom P, Miettinen P, Niskanen L. Laparoscopic versus open cholecystectomy in diabetic patients and postoperative outcome. *Surg Endosc.* 2011 Mar;25(3):764-70.
228. Capizzi FD, Fogli L, Brulatti M, Boschi S, Di Domenico M, Papa V, et al. Conversion rate in laparoscopic cholecystectomy: evolution from 1993 and current state. *J Laparoendosc Adv Surg Tech A.* 2003 Apr;13(2):89-91.
229. Feliu Pala X, Fernandez Sallent E, Claveria Puig R, Abad Ribalta JM. Evolution of laparoscopic cholecystectomy in the regional hospitals of Catalonia. *Rev Esp Enferm Dig.* 2000 Apr;92(4):211-21.
230. Braun K, Stern S. [The role of chemoreceptor stimulation in the blood pressure response to serotonin]. *Angeiologie.* 1962 Nov-Dec;14:5-11.
231. Pires JG, Silva SR, Ramage AG, Futuro-Neto HA. Evidence that 5-HT₃ receptors in the nucleus tractus solitarius and other brainstem areas modulate the vagal bradycardia evoked by activation of the von Bezold-Jarisch reflex in the anesthetized rat. *Brain Res.* 1998 Apr 27;791(1-2):229-34.
232. Ma D, Chakrabarti MK, Whitwam JG. Propofol, bradycardia and the Bezold-Jarisch reflex in rabbits. *Br J Anaesth.* 1999 Mar;82(3):412-7.
233. Kinsella SM, Tuckey JP. Perioperative bradycardia and asystole: relationship to vasovagal syncope and the Bezold-Jarisch reflex. *Br J Anaesth.* 2001 Jun;86(6):859-68.
234. Futuro Neto HA, Macedo SM, Silva NF, Cabral AM, Pires JG. Central 5-HT_{2A} receptors modulate the vagal bradycardia in response to activation of the von Bezold-Jarisch reflex in anesthetized rats. *Braz J Med Biol Res.* 2011 Mar;44(3):224-8.
235. Owczuk R, Wenski W, Polak-Krzeminska A, Twardowski P, Arszulowicz R, Dylczyk-Sommer A, et al. Ondansetron given intravenously attenuates arterial blood pressure drop due to spinal anesthesia: a double-blind, placebo-controlled study. *Reg Anesth Pain Med.* 2008 Jul-Aug;33(4):332-9.

236. Villalon CM, Terron JA, Hong E, Saxena PR. [The cardiovascular effects of serotonin receptor agonists and antagonists (I)]. *Arch Inst Cardiol Mex.* 1993 Sep-Oct;63(5):441-7.
237. Villalon CM, Terron JA, Hong E, Saxena PR. [The cardiovascular effects of serotonin receptor agonists and antagonists (II)]. *Arch Inst Cardiol Mex.* 1993 Nov-Dec;63(6):553-61.
238. Ortiz-Gomez JR, Palacio-Abizanda FJ, Morillas-Ramirez F, Fornet-Ruiz I, Lorenzo-Jimenez A, Bermejo-Albares ML. The effect of intravenous ondansetron on maternal haemodynamics during elective caesarean delivery under spinal anaesthesia: a double-blind, randomised, placebo-controlled trial. *Int J Obstet Anesth.* 2014 May;23(2):138-43.
239. Martinek RM. Witnessed asystole during spinal anesthesia treated with atropine and ondansetron: a case report. *Can J Anaesth.* 2004 Mar;51(3):226-30.
240. Wang Q, Zhuo L, Shen MK, Yu YY, Yu JJ, Wang M. Ondansetron preloading with crystalloid infusion reduces maternal hypotension during cesarean delivery. *Am J Perinatol.* 2014 Nov;31(10):913-22.
241. Tiwari S, Chauhan A, Chatterjee P, Alam MT. Laparoscopic cholecystectomy under spinal anaesthesia: A prospective, randomised study. *J Minim Access Surg.* 2013 Apr;9(2):65-71.
242. White PF, Tang J, Hamza MA, Ogunnaike B, Lo M, Wender RH, et al. The use of oral granisetron versus intravenous ondansetron for antiemetic prophylaxis in patients undergoing laparoscopic surgery: the effect on emetic symptoms and quality of recovery. *Anesth Analg.* 2006 May;102(5):1387-93.
243. Helmy SA. Prophylactic anti-emetic efficacy of ondansetron in laparoscopic cholecystectomy under total intravenous anaesthesia. A randomised, double-blind comparison with droperidol, metoclopramide and placebo. *Anaesthesia.* 1999 Mar;54(3):266-71.
244. Wilde MI, Markham A. Ondansetron. A review of its pharmacology and preliminary clinical findings in novel applications. *Drugs.* 1996 Nov;52(5):773-94.
245. Naylor RJ, Rudd JA. Pharmacology of ondansetron. *Eur J Anaesthesiol Suppl.* 1992 Nov;6:3-10.
246. Abouleish EI, Rashid S, Haque S, Giezentanner A, Joynton P, Chuang AZ. Ondansetron versus placebo for the control of nausea and vomiting during Caesarean section under spinal anaesthesia. *Anaesthesia.* 1999 May;54(5):479-82.
247. Erben M. [New, in Austria registered specialty drugs. Zofran (Ondansetron, Glaxo)]. *Wien Klin Wochenschr.* 1991;103(19):594-601.
248. V K, Pujari VS, R SM, Hiremath BV, Bevinaguddaiah Y. Laparoscopic Cholecystectomy Under Spinal Anaesthesia vs. General Anaesthesia: A Prospective Randomised Study. *J Clin Diagn Res.* 2014 Aug;8(8):NC01-4.
249. Trabelsi W, Romdhani C, Elaskri H, Sammoud W, Bensalah M, Labbene I, et al. Effect of Ondansetron on the Occurrence of Hypotension and on Neonatal Parameters during Spinal Anesthesia for Elective Caesarean Section: A Prospective, Randomized, Controlled, Double-Blind Study. *Anesthesiol Res Pract.* 2015;2015:158061.

تأثير عقار الأوندانسترون لتقليل انخفاض ضغط الدم الناتج عن التخدير تحت الأم العنكبوتية في حالات استئصال المرارة بالمنظار

الملخص العربي

• الهدف من البحث:

هدف هذا البحث كان دراسة تأثير عقار الأوندانسترون لتقليل انخفاض ضغط الدم الناتج عن التخدير تحت الأم العنكبوتية في حالات استئصال المرارة بالمنظار .

• المرضى :

أجريت هذه الدراسة على ٤٠ مريضاً بالغاً من الجنسين داخل المستشفى الجامعي بالاسكندرية وقد تم إعداد هؤلاء المرضى لإجراء استئصال المرارة بالمنظار عن طريق التخدير الشوكي. تم تقسيم المرضى عشوائياً إلى مجموعتين متساويتين (٢٠ مريض في كل مجموعة).

- المجموعة الأولى : شملت ٢٠ مريضاً تم اعطائهم ٤مجم من عقار الاوندانسترون المحلل بمحلول ملحي (١٠ مل) قبل التخدير تحت الأم العنكبوتية بخمس دقائق.

- المجموعة الثانية : شملت ٢٠ مريضاً تم اعطائهم محلول ملحي (١٠ مل) قبل التخدير تحت الأم العنكبوتية بخمس دقائق.

• طريقة البحث :

تم تقييم المرضى قبل اجراء التدخل الجراحي عن طريق السؤال عن التاريخ المرضي والأمراض المصاحبة ان وجدت ثم توقيع الكشف الاكلينيكي و اجراء التحاليل والفحوصات المطلوبة. تم اتصال المريض بجهاز لقياس العلامات الحيوية قبل اجراء التخدير الشوكي بواسطة نفس طبيب التخدير واعطاء المريض العقار المستخدم حسب المجموعات المذكورة سابقاً.

تم ملاحظة العمر، الجنس، الوزن، مدة العملية ثم أجريت القياسات التالية:

١- معدل النبض في الدقيقة.

٢- متوسط ضغط الدم الشرياني.

٣- نسبة تشبع الدم الشرياني بالأكسجين.

وقد تمت القياسات قبل التخدير الشوكي ثم عند ٥، ١٠، ١٥ ثم كل ١٥ دقيقة حتي انتهاء زمن العملية بحد اقصي ساعتان ثم كل ساعة لمدة ٦ ساعات بعد العملية.

٤- تم قياس نسبة غاز ثاني أكسيد الكربون في اثناء الزفير بعد التخدير الشوكي مباشرة ثم كل ١٥ دقيقة من بداية بدء العملية وحتى مرور ساعتين.

- ٥- تم قياس معدل حدوث الغثيان والقيء كل ١٥ دقيقة من بداية العملية حتي انتهائها وبمعدل كل ساعة لمدة ٦ ساعات بعد العملية.
- ٦- تم قياس معدل السكون للمرضي كل ١٥ دقيقة من بداية العملية حتي انتهائها وبمعدل كل ساعة لمدة ٦ ساعات بعد العملية.
- ٧- تم قياس معدل الاستحسان للمرضي بعد انتهاء العملية.
- ٨- تم قياس معدل الاستحسان للجراحين بعد انتهاء العملية.
- ٩- تم ملاحظة وتسجيل المضاعفات التي حدثت أثناء وبعد العملية.

• النتائج :

لوحظ من هذه الدراسة الآتي:

- ١- عدم وجود اختلافات ملحوظة بين المجموعتين بالنسبة إلى العمر، الجنس، الوزن أو مدة العملية.
- ٢- معدل النبض كان أقل في المجموعة الثانية بالمقارنة بالمجموعة الأولى بصورة ملحوظة عند زمن ١٠/١٥/١١/١٥/٣٠/٤٥/٦٠/٧٥/٩٠/١٠٥/١٢٠ دقيقة بعد التخدير الشوكي أثناء العملية وبعد مرور ساعة بعد انتهاء العملية مع عدم وجود اية اختلافات ملحوظة عدا ذلك.
- ٣- معدل ضغط الدم الشرياني كان أقل في المجموعة الثانية عنه في المجموعة الأولى بصورة ملحوظة عند زمن ١٠/١٥/٣٠/٤٥/٦٠/٧٥/٩٠/١٠٥/١٢٠ دقيقة بعد التخدير الشوكي أثناء العملية مع عدم وجود اية اختلافات ملحوظة عدا ذلك.
- ٤- عدم وجود اختلافات احصائية ملحوظة بالنسبة لمعدل تشبع الدم الشرياني بالأكسجين أثناء العملية أو بعد انتهائها بين المجموعتين.
- ٥- عدم وجود اختلافات احصائية ملحوظة بالنسبة الي قياس نسبة غاز ثاني أكسيد الكربون في أثناء الزفير أثناء العملية بين المجموعتين.
- ٦- معدل حدوث الغثيان والقيء كان أعلى بصورة ملحوظة احصائيا في المجموعة الثانية عنه في المجموعة الأولى عند ١٥/٤٥/٧٥ دقيقة بعد التخدير الشوكي أثناء العملية وعند ٥ ساعات بعد انتهاء العملية مع عدم وجود أية اختلافات ملحوظة أخرى بين المجموعتين.
- ٧- عدم وجود اختلافات احصائية ملحوظة بالنسبة لمعدل السكون للمرضي أثناء العملية أو بعد انتهائها بين المجموعتين.
- ٨- معدل الاستحسان للمرضي كان أعلى في المجموعة الأولى عنه في المجموعة الثانية بصورة ملحوظة.
- ٩- معدل الاستحسان للجراحين كان أعلى في المجموعة الأولى عنه في المجموعة الثانية بصورة ملحوظة.
- ١٠- المضاعفات التي حدثت أثناء العملية كانت كالتالي :

في المجموعة الاولى: ١٠% من المرضي شعروا بالألم في الكتف مع عدم وجود أية حالات من هبوط بالتنفس، الألم الصدر، الصداع بعد التخدير الشوكي ، احتباس بولي أو الاحساس بالحكة بالجلد.

في المجموعة الثانية: ٥ % من المرضى شعروا بالألم في الكتف و٥% شعروا بالصداع بعد التخدير الشوكي مع عدم وجود أية حالات من هبوط بالتنفس، ألم الصدر، الاحتباس البولي أو الاحساس بالحكة بالجلد.

• الاستنتاجات :

- ١- اعطاء ٤ مجم وريدي من عقار الاوندانسيترون يقلل من انخفاض ضغط الدم الشرياني و يقلل من هبوط معدل ضربات القلب الناتج بعد التخدير الشوكي.
- ٢- اعطاء ٤ مجم وريدي من عقار الاوندانسيترون يقلل من الشعور بالغثيان والقيء بعد التخدير الشوكي.

• التوصيات:

- ١- اعطاء ٤مجم وريدي من عقار الاوندانسيترون قبل بدء العملية لتقليل انخفاض ضغط الدم الشرياني المصاحب للتخدير الشوكي.
- ٢- دراسة تأثير جرعات مختلفة من عقار الاوندانسيترون علي معدل ضغط الدم الشرياني أثناء التخدير الشوكي.