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Study on Analgesic Effects of Combined Thoracic Paravertebral Block Anesthesia or Erector Spinae Plane Block with Ultrasound Guided Transversus Abdominis Plane Block in Endoscopic Esophagectomy: A Clinical Anatomical Approach

Estudio sobre los Efectos Analgésicos de la Anestesia Combinada con Bloqueo Paravertebral Torácico o el Bloqueo del Plano del Erector de la Columna con Bloqueo del Plano Transverso del Abdomen Guiado por Ultrasonido en la Esofagectomía Endoscópica: Un Enfoque Anatómico Clínico

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LI, C.; CAI, Q.; LIU, W.; ZHOU, L. & CHEN, W. Study on analgesic effects of combined thoracic paravertebral block anesthesia or erector spinae plane block with ultrasound-guided transversus abdominis plane block in endoscopic esophagectomy: A clinical anatomical approach. *Int. J. Morphol., 42(2)*:301-307, 2024.

SUMMARY: The application effect of transversus abdominis plane block (TAPB) combined with thoracic paravertebral block (TPVB) or erector spinae plane block (ESP) under ultrasound guidance in endoscopic radical resection of esophageal cancer under general anesthesia was studied. From March 2021 to February 2022, patients who underwent endoscopic radical resection of esophageal cancer in our hospital were selected as the research object, and 90 patients were selected as the samples. Patients were divided into group A and group B according to the difference of blocking schemes. Group A received ESP and Group B received TPVB. The dosage of sufentanil, nerve block time, awakening time and extubation time of the two groups were counted. The postoperative pain, sedation effect, sleep satisfaction and analgesia satisfaction of the two groups were compared, and the complications of the two groups were observed. The nerve block time and extubation time in group A were shorter than those in group B (P<0.05), but there was no statistical difference in the dosage of sufentanil and the awakening time between the two groups (P>0.05). At T2, T3 and T4, the visual analogue scale (VAS) scores of group A at rest and cough were significantly lower than those of group B (P<0.05). At T1, T2 and T3, the Ramsay score of group A was lower than that of group B (P<0.05), and there was no significant difference between the two groups at T4 (P>0.05). The satisfaction of sleep and analgesia in group A was higher than that in group B (P<0.05). There was no significant difference in the incidence of adverse reactions between group A and group B (P>0.05). The analgesic effect of ultrasound-guided TAPB combined with ESP is better than that of ultrasound-guided TAPB combined with TPVB, and it can shorten the time of nerve block and extubation, which is worth popularizing.

KEY WORDS: Endoscopic esophagectomy; Transversus abdominis plane block; Thoracic paravertebral block; Erector spinae plane block; Analgesic effect.

INTRODUCTION

Surgical resection is one of the most effective treatments for esophageal cancer in the early and middle stages. Endoscopic esophagectomy is a typical minimally invasive surgical procedure assisted by television endoscopy, which can effectively remove the cancerous tissue and improve the prognosis of the patient (Perry *et al*., 2021; Dunn *et al*., 2022). Ultrasound-guided general anesthesia is a conventional anesthesia method for endoscopic esophagectomy, but in order to avoid postoperative pain and affect the postoperative efficacy of patients, analgesic therapy is also needed. With the maturity of visual ultrasound technology, not only the efficiency of regional nerve block is significantly improved, but also a new scheme is added for esophageal cancer surgery analgesia (Sharma *et al*.,

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2020). Transversus abdominis plane block guided by ultrasound is efficient in blocking the large-scale conduction of pain signals and thus inhibiting pain (Hayami *et al*., 2021). At present, thoracic paravertebral block (Fig. 1) or erector spinae plane block (Fig. 2) combined with TAPB anesthesia is commonly used in clinical practice, both of which can meet the block requirements of endoscopic surgery. Among them, TPVB can significantly inhibit the surgical stress response with few complications (Chin & El-Boghdadly, 2021). ESP as a new planar block technique, which can also alleviate the pain stress in video-assisted thoracoscopic surgery by blocking the spinal nerves (Qiu *et al*., 2020). Both TPVB and ESP have achieved good analgesic effect during the perioperative period of thoracic surgery, but they have their own limitations. Moreover? there are few reports on the analgesic effects of two blocking schemes in endoscopic esophageal cancer at home and abroad. In view of this, we compared the effectiveness of ultrasound guided TAPB combined with TPVB or ESP in endoscopic esophageal cancer radical surgery, aiming to provide the basis for the formulation of clinical anesthesia scheme of regional block endoscopic esophageal cancer radical surgery.

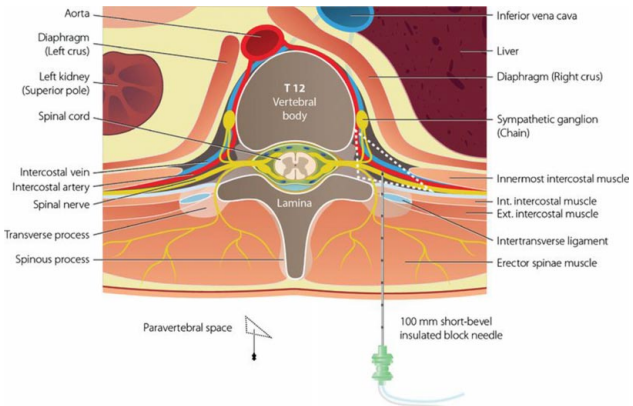

Fig. 1. Anatomical representation of thoracic paravertebral block with ultrasound.

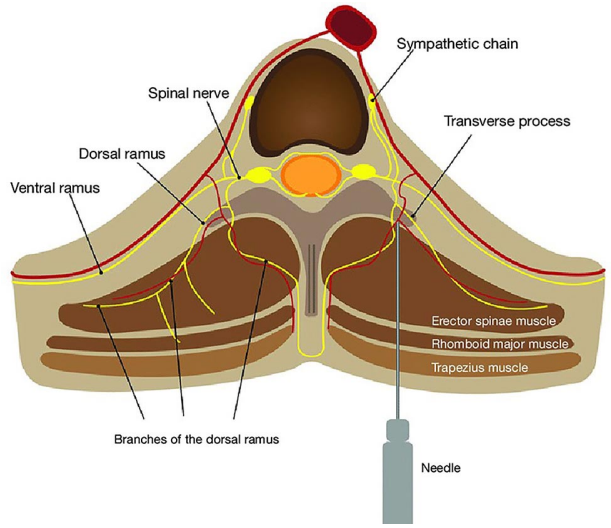

Fig. 2. Anatomical representation of erector spinae block with ultrasound.

MATERIAL AND METHOD

Study population. From March 2021 to February 2022, patients who underwent endoscopic radical resection of esophageal cancer in our hospital were selected as the research object. According to the difference of blocking protocol, the patients were divided into group A and group B.

This study was approved by the Ethics Committee of Hubei Provincial People's Hospital Affiliated to Medical College of Shantou University, China (20210186). And all the subjects signed the informed consent agreement.

Inclusion criteria. 1. The pathological diagnosis of esophageal cancer through needle biopsy (Gürkan *et al*., 2020); 2. Patients with indications for endoscopic radical resection of esophageal cancer; 3. Those with American Society of Anesthesiologists (ASA) grades I-III (Garbin *et al*., 2021); 4. Patients without preoperative history of radiotherapy, chemotherapy, and biological treatment.

Exclusions criteria. 1. Those under 18 years old; 2. Patients with severe bradycardia and hypotension; 3. Those who were allergic to the anesthetics and analgesic drugs used in our study; 4. Patients who took analgesic drugs for a long time before entering the group; 5. Patients with previous endoscopic surgery.

Surgical procedure. Patients in both groups were forbidden to eat and drink for 8 hours before operation, and no medication was used before operation. After entering the operating room, invasive blood pressure, electrocardiogram, blood oxygen saturation, end-expiratory carbon dioxide partial pressure and bispectral index were monitored, venous access was created, and Ringer's solution of sodium lactate was given intravenous drip therapy.

TAPB was guided by ultrasound before anesthesia induction. Color ultrasonic diagnostic instrument was used for analgesia, and the frequency of linear array high-frequency probe was 8 ~ 13 MHz. Patients were instructed to remain in the supine position and the puncture site was disinfected. Place the probe until it reaches the xiphoid process. Under the guidance of ultrasound, Bellon's puncture needle was used to puncture the fascia of internal oblique abdominal muscle and transverse abdominal muscle, and then 20 ml of ropivacaine (0.375 %) was injected into the plane of both transverse abdominal muscles.

Then, group A and group B were then treated with ESP and TPVB, respectively.

The operation method of group A. Instruct the patient to take the lateral position, disinfect the puncture site, place the probe at T4 spinous process, scan in median sagittal position, move out about 2 cm, and reach T5 transverse process. Erector spinae can be seen by ultrasound. After blocking the needle into the needle and drawing back no blood, 20 ml of ropivacaine (0.375 %) was injected deep into erector spinae.

The operation method of group B. Instruct the patient to take the lateral position, place the probe in the paraspinal space of T5 after disinfection, and the triangular space formed by pleura, T5 transverse process and transverse process ligament can be seen. Puncture with in-plane technique and inject 20 ml of ropivacaine (0.375 %) into the triangular space after blood withdrawal.

The anesthesia induction scheme was target-controlled infusion of propofol with a concentration of 3.5 mg/L. Fentanyl (3 μg/kg)+ Atracurium (0.3 mg/kg) was infused. During the operation, the actual concentration of target-controlled plasma was adjusted according to the patient's response. Target concentrations of remifentanil and propofol for target-controlled infusion were 3–5 μg/L and 2-4 mg/L respectively When MAP<60 mmHg and heart rate < 50 beats /min, vasoactive drugs were given for symptomatic treatment. Stop using propofol 5 min before the operation. Postoperative patient-controlled intravenous analgesia pump, sufentanil 100 mg, nalbuphine 80 mg, flurbiprofen ester 200 mL, infusion dosage of 4 ml/h, single dose of 0.5 mL, locking time of 15 min.

Observation indicators

1. The doses of remifentanil and the nerve block time as well as the postoperative awakening and extubation time were counted in the two groups.
2. Postoperative pain: Compare the pain in resting state and cough state at extubation (T1), 12 h(T2), 24 h(T3), 48 h(T4) after operation, respectively. The pain severity in both groups was assessed using VAS scores, which had a total of 10 points (Wang *et al*., 2020). The score was in direct proportion to the degree of pain.
3. Sedation effect: The Ramsay scale was used to assess the sedation effect on T1, T2, T3 and T4. Specific criteria: 1 point for anxiety and irritability; 2 points for sober and quiet cooperation; 3 points for sleepiness, slow response to instructions; 4 points for shallow sleep, can wake up quickly; 5 points for falling asleep and being unresponsive to call stimulation; 6 points for deep sleep and unresponsiveness to call stimulation (Xiong *et al*., 2021).
4. Sleep satisfaction and analgesic satisfaction: Sleep satisfaction questionnaire was used to evaluate the sleep status. The scale score ranged from 0 to 10, and the score was in direct proportion to satisfaction. Evaluation criteria for analgesic satisfaction: 0 point for dissatisfaction, 1 point for general satisfaction, 2 points for satisfaction and 3 points for very satisfaction.
5. Compare the incidence of hematoma, nerve injury, pneumothorax, and block failure, as well as postoperative gastrointestinal reactions, respiratory depression, skin itching and other adverse reactions between the two groups.

Sample size calculation method. The sample size was calculated according to the formula of sample size = [the maximum number of items in the scale ×(5-10)]×(1+20 %). There were 10 items in the sleep satisfaction questionnaire in the study, and 20 % of the samples were lost and invalid, and finally the sample size was determined to be 90 cases.

Statistical methods. SPSS 20.0 software is used for statistical analysis. The measurement data in the measurement data are expressed by the average standard deviation, and T-test is used between groups. Repeated measurement variance analysis is carried out for the same group in different periods. The counting data is expressed by the number of cases (percentage), and the χ^2 test is used between groups; α=0.05.

RESULTS

Comparison of two groups of general data. The basic data between the two groups were shown in Table I, and there was no significant difference between the two groups (P>0.05), indicating that they were comparable.

Comparison of remifentanil dosage, nerve block time, awakening time and extubation time between the two groups. The blocking time and extubation time in the two groups were higher than those in the group A, but the differences in remifentanil dose and awakening time between the two groups were not statistically significant (P > 0.05), as shown in Table II.

Comparison of pain between the two groups at different time points. On T1, there was no significant difference in VAS scores between the two groups in resting state and cough state (P > 0.05). At T2, T3 and T4, the VAS scores of group A in the resting state and the cough state were significantly lower than those of group B, and the differences were statistically significant (P < 0.05), as shown in Figure 3.

Table I. Comparison of the basic data of the two groups.

Group	Age (year)	Sex		Course of disease (year)	ASA grade			BMI (kg/^{2})
		Male	Female		I	II	III	
Group A (n=45)	51.87±6.59	25	20	1.48±0.25	18	15	12	22.18±2.47
Group B (n=45)	51.63±6.47	23	22	1.55±0.23	17	13	15	22.11±2.36
t/χ^2 value	0.174	0.179		1.382		0.505		0.138
P value	0.862	0.673		0.170		0.777		0.891

Table II. Comparison of remifentanil dosage, nerve block time, awakening time and extubation time between the two groups (x̄±S).

Group	Remifentanil dosage (μg)	Nerve block time (min)	Awakening time (min)	Extubation time (min)
Group A (n=45)	46.26±1.15	11.59±3.52	2.74±1.02	11.59±3.63
Group B (n=45)	45.39±1.13	18.59±3.63	2.79±1.08	16.58±3.71
t value	0.541	9.287	0.226	6.449
P value	0.590	<0.001	0.822	<0.001

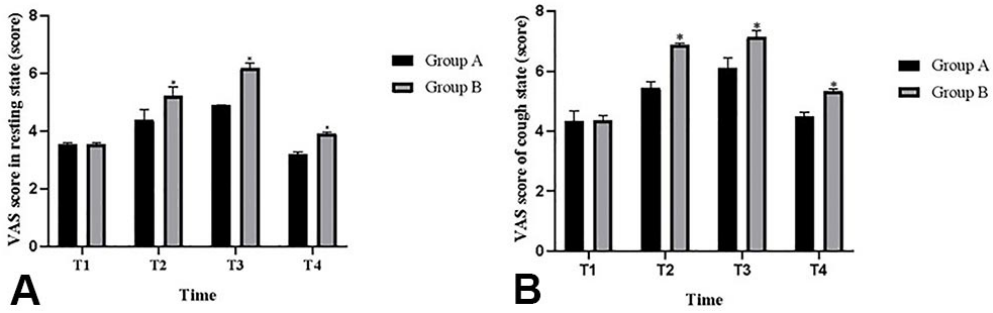

Fig. 3. Comparison of VAS scores between the two groups at different time points (Note: A. Comparison of VAS scores between the two groups in the resting state; B. Comparison of VAS scores of patients under cough between the two groups. Compared with the group A, **P*<0.05)

Comparison of Ramsay scores at different time points between the two groups. At T1, T2 and T3, the Ramsay scores of the two groups were lower than that of the group A (P < 0.05), while at T4, there was no significant difference in the Ramsay scores of the two groups (P > 0.05), as shown in Figure 4.

Comparison of sleep satisfaction and analgesic satisfaction between the two groups. The sleep satisfaction and analgesic satisfaction in group A were higher than those in group B (P < 0.05), as shown in Table III.

Comparison of the incidence of adverse reactions between the two groups. In group A, there were three cases of gastrointestinal reactions, and the incidence of adverse reactions was 6.67 %. In group B, there were one case of hematoma, two cases of gastrointestinal reactions, and one case of respiratory depression. The incidence of adverse reactions was 8.89 %, and there was no significant difference in the incidence of adverse reactions between group A and group B (χ^2=0.155, P=0.694).

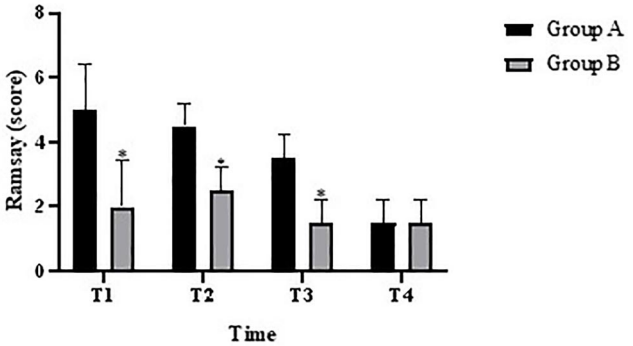

Fig. 4. Comparison of Ramsay scores between the two groups at different time points (Note: **P*<0.05).

Table III. Comparison of sleep satisfaction and analgesic satisfaction between two group (±S, score).

Group	Sleep satisfaction	Analgesic
Group A (n=45)	8.19±1.21	2.25±0.33
Group B (n=45)	6.55±1.38	1.84±0.45
t value	5.994	4.929
P value	<0.001	<0.001

DISCUSSION

Adequate perioperative analgesia can reduce the incidence of adverse events and chronic pain syndrome. Therefore, the selection of analgesic scheme for endoscopic radical resection of esophageal cancer is also an important part in determining the surgical efficacy TAPB therapy under ultrasound guidance is efficient in blocking the large-scale conduction of pain signals and inhibiting the pain during surgery (Peltrini *et al*., 2020). However, endoscopic radical resection of esophageal cancer mostly adopts three-incision of neck, thorax, and abdomen, which requires a wide range of block (Issa *et al*., 2020). In addition, the placement of closed thoracic drainage after surgery stimulates intercostal nerves and pleura. These reasons can lead to obvious pain in patients after surgery (Miyata *et al*., 2021). Therefore, TAPB alone is insufficient to meet the analgesic requirements in the surgical area for radical esophagectomy (Finnerty *et al*., 2020). Nowadays, multi-mode analgesia has become a trend, and it is advocated to use a variety of analgesic drugs or techniques to improve the analgesic effect and reduce drug-related adverse reactions (Saadawi *et al*., 2021).

TPVB, ESP and other methods are often used for analgesic management after endoscopic surgery, but each has its own limitations. TPVB is a more common analgesic method by blocking the spinal nerves and ramification in the thoracic para-space (Viderman *et al*., 2021). Due to the continuity of its anatomical structure in the paravertebral space, drugs can diffuse upward and downward after a single point of injection, blocking multiple skin segments (El Shora *et al*., 2020). Besides, TPVB can prevent peripheral and central sensitization and inhibit hyperalgesia. Therefore, the analgesic effect of TPVB has been very exact. However, the limitation of this drug is that it is not suitable for patients with abnormal heart function, lung function and coagulation function (Hu *et al*., 2020).

ESP is a blocking technique to make drugs spread vertically through erector spinae plane, which can block the dorsal and ventral branches of spinal nerve. It is found that ESP can provide good analgesia for chest neuropathic pain and abdominal surgery pain (Ruscio *et al*., 2020). Studies have shown that the dorsal and ventral branches of the spinal nerve were blocked due to longitudinal diffusion of the drug through the erector spinae plane. At the same time, local anesthetics can inhibit visceral pain after reaching the paravertebral region (El-Boghdadly *et al*., 2021). Based on this, ESP can produce extensive sensory block of anterior chest wall and lateral chest wall in skin area. Therefore, ESP can meet the blocking requirements of endoscopic surgery, and will not seriously affect the circulatory function. In addition, clinical practice has revealed that compared with TPVB, ESP is simpler to operate, and the anatomical position can be easily identified under ultrasound. Less affected by obesity, spinal deformity or combined pleural effusion.

The comparison of nerve block time and extubation time between the two groups in this study showed that compared with TPVB, TAPB combined with ESP could reduce the doses of anesthetics and reduce the effects of anesthesia on the body. Meanwhile, the comparative results of VAS score and Ramsay score in resting state and cough state of two groups at different time points indicated that the combination of TAPB and ESP was beneficial to enhance the analgesic effect and effectively prevent the occurrence of agitation during extubation. This is mainly because when ropivacaine is injected into the space between erector spinae and transverse process of lumbar vertebra, the drug can spread to both ends along with the shape of muscular fasciae, thus blocking the excitation of adjacent spinal nerve segments, exerting an efficient analgesic effect, and reducing postoperative pain reaction (Nedeljkovic *et al*., 2020; Grape *et al*., 2021).

The scores of postoperative sleep satisfaction and analgesic satisfaction of the two groups were higher than those of the group A, further indicating that both ultrasonic-guided TAPB and ESP were conducive to the early recovery of patients undergoing thoracic surgery and easily accepted by patients. In addition, there was 1 case of hematoma in group B in this study, while there was no hematoma in group A. The reason for this was that during ultrasound-guided ESP, the injection points were shallower than the surface, and the injection points were far away from the main organs (Hamid *et al*., 2020). Moreover, the puncture path does not pass through an important structure, thereby significantly reducing the risks of serious complications such as nerve injury and puncture failure. However, the incidence of adverse reactions between the two groups was not statistically significant.

Limitations. This may be the reason for the small sample size, which is also the limitation of this study. In the future, it is necessary to include more sample size, expand the research scope, and further explore the most suitable anesthesia scheme in endoscopic radical resection of esophageal cancer.

CONCLUSIONS

To sum up, in endoscopic radical resection of esophageal cancer, the postoperative analgesic effects of ultrasound-guided TAPB combined with ESP are better than that of ultrasound-guided TAPB combined with TPVB, and the nerve block and extubation time can be shortened, which is worthy of promotion.

Ethic statement. This study was approved by the Ethics Committee of Hubei Provincial People's Hospital Affiliated to Medical College of Shantou University, China (20210186). And all the subjects signed the informed consent agreement. The study has been designed in accordance with the Declaration of Helsinki. We assure that the study will be conducted with the utmost transparency and respect for human rights. The informed consent was obtained from all the participants.

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LI, C.; CAI, Q.; LIU, W.; ZHOU, L. & CHEN, W. Estudio sobre los efectos analgésicos de la anestesia combinada con bloqueo paravertebral torácico o el bloqueo del plano del erector de la columna con bloqueo del plano transverso del abdomen guiado por ultrasonido en la esofagectomía endoscópica: un enfoque anatómico clínico. *Int. J. Morphol., 42(2)*:301-307, 2024.

RESUMEN: Se estudió el efecto de la aplicación del bloqueo del plano transverso del abdomen (TAPB) combinado con el bloqueo paravertebral torácico (TPVB) o el bloqueo del plano del erector de la columna (ESP) bajo guía ecográfica en la resección radical endoscópica del cáncer de esófago bajo anestesia general. Desde marzo de 2021 hasta febrero de 2022, en nuestro hospital, se seleccionaron como objeto de investigación pacientes sometidos a resección radical endoscópica de cáncer de esófago, y como muestra se seleccionaron 90 pacientes. Los pacientes se dividieron en el grupo A y el grupo B según la diferencia de esquemas de bloqueo. El grupo A recibió ESP y el grupo B recibió TPVB. Se contaron la dosis de sufentanilo, el tiempo de bloqueo nervioso, el tiempo de despertar y el tiempo de extubación de los dos grupos. Se compararon el dolor posoperatorio, el efecto de la sedación, la satisfacción del sueño y la satisfacción de la analgesia de los dos grupos y se observaron las complicaciones de los dos grupos. El tiempo de bloqueo nervioso y el tiempo de extubación en el grupo A fueron más cortos que los del grupo B (P<0,05), pero no hubo diferencias estadísticas en la dosis de sufentanilo y el tiempo de despertar entre los dos grupos (P>0,05). En T2, T3 y T4, las puntuaciones de la escala visual analógica (EVA) del grupo A en reposo y tos fueron significativamente más bajas que las del grupo B (P <0,05). En T1, T2 y T3, la puntuación de Ramsay del grupo A fue menor que la del grupo B (P<0,05) y no hubo diferencias significativas entre los dos grupos en T4 (P>0,05). La satisfacción del sueño y la analgesia en el grupo A fue mayor que en el grupo B (P<0,05). No hubo diferencias significativas en la incidencia de reacciones adversas entre el grupo A y el grupo B (P>0,05). El efecto analgésico de la TAPB guiada por ecografía combinada con ESP es mejor que el de la TAPB guiada por ecografía combinada con TPVB, y puede acortar el tiempo de bloqueo nervioso y extubación, lo que vale la pena popularizar.

PALABRAS CLAVE: Esofagectomía endoscópica; Bloqueo del plano transverso del abdomen; Bloqueo paravertebral torácico; Bloqueo del plano del erector de la columna; Efecto analgésico.

REFERENCES

Chin, K. J. & El-Boghdadly, K. Mechanisms of action of the erector spinae plane (ESP) block: a narrative review. *Can. J. Anaesth., 68(3)*:387-408, 2021.

Dunn, J. M.; Reyhani, A.; Santaolalla, A.; Zylstra, J.; Gimson, E.; Pennington, M.; Baker, C.; Kelly, M.; Van Hemelrijck, M.; Lagergren, J.; *et al*. Transition from esophagectomy to endoscopic therapy for early esophageal cancer. *Dis. Esophagus, 35(3)*:doab047, 2022.

El Shora, H. A.; El Beleehy, A. A.; Abdelwahab, A. A.; Ali, G. A.; Omran, T. E.; Hassan, E. A. & Arafat, A. A. Bilateral paravertebral block versus thoracic epidural analgesia for pain control post-cardiac surgery: a randomized controlled trial. *Thorac. Cardiovasc. Surg., 68(5)*:410-16, 2020.

El-Boghdadly, K.; Desai, N.; Halpern, S.; Blake, L.; Odor, P. M.; Bampoe, S.; Carvalho, B. & Sultan, P. Quadratus lumborum block vs. transversus abdominis plane block for caesarean delivery: a systematic review and network meta-analysis. *Anaesthesia, 76(3)*:393-403, 2021.

Finnerty, D. T.; McMahon, A.; McNamara, J. R.; Hartigan, S. D.; Griffin, M. & Buggy, D. J. Comparing erector spinae plane block with serratus anterior plane block for minimally invasive thoracic surgery: a randomised clinical trial. *Br. J. Anaesth., 125(5)*:802-10, 2020.

Garbin, M.; Bertolizio, G. & Portela, D. A. Thoracic paravertebral block for an opioid-free thoracotomy in a dog. *Vet. Anaesth. Analg., 48(4)*:622-3, 2021.

Grape, S.; Kirkham, K. R.; Akiki, L. & Albrecht, E. Transversus abdominis plane block versus local anesthetic wound infiltration for optimal analgesia after laparoscopic cholecystectomy: A systematic review and meta-analysis with trial sequential analysis. *J. Clin. Anesth., 75*:110450, 2021.

Gürkan, Y.; Aksu, C.; Kus¸, A. & Yörükog˘lu, U. H. Erector spinae plane block and thoracic paravertebral block for breast surgery compared to IV-morphine: A randomized controlled trial. *J. Clin. Anesth., 59*:84-8, 2020.

Hamid, H. K. S.; Ahmed, A. Y.; Saber, A. A.; Emile, S. H.; Ibrahim, M. & Ruiz-Tovar, J. Transversus abdominis plane block using a short-acting local anesthetic reduces pain and opioid consumption after laparoscopic bariatric surgery: a meta-analysis. *Surg. Obes. Relat. Dis., 16(9)*:1349-57, 2020.

Hayami, M.; Klevebro, F.; Tsekrekos, A.; Samola Winnberg, J.; Kamiya, S.; Rouvelas, I.; Nilsson, M. & Lindblad, M. Endoscopic vacuum therapy for anastomotic leak after esophagectomy: a single-center's early experience. *Dis. Esophagus, 34(9)*:doaa122, 2021.

Hu, L. H.; Xu, X.; Shen, W. Y.; Qi, Y.; Tian, H. & He, J. X. Application of thoracoscopy-guided thoracic paravertebral block for analgesia after single-port video-assisted pulmonary lobectomy. *Zhonghua Yi Xue Za Zhi, 100(33)*:2596-600, 2020.

Issa, D.; Patel, M. & Shah, T. Esophagectomy versus endoscopic resection for T1b esophageal adenocarcinoma: Depth matters! *Gastrointest. Endosc., 92(5)*:1147-8, 2020.

Miyata, H.; Sugimura, K.; Kanemura, T.; Takeoka, T.; Yamamoto, M.; Shinno, N.; Hara, H.; Omori, T.; Yamamoto, S.; Ishihara, R.; *et al*. Clinical outcome of additional esophagectomy after endoscopic treatment for superficial esophageal cancer. *Ann. Surg. Oncol., 28(12)*:7230-9, 2021.

Nedeljkovic, S. S.; Kett, A.; Vallejo, M. C.; Horn, J. L.; Carvalho, B.; Bao, X.; Cole, N. M.; Renfro, L.; Gadsden, J. C.; Song, J.; *et al*. Transversus abdominis plane block with liposomal bupivacaine for pain after cesarean delivery in a multicenter, randomized, double-blind, controlled trial. *Anesth. Analg., 131(6)*:1830-9, 2020.

Peltrini, R.; Cantoni, V.; Green, R.; Greco, P. A.; Calabria, M.; Bucci, L. & Corcione, F. Efficacy of transversus abdominis plane (TAP) block in colorectal surgery: a systematic review and meta-analysis. *Tech. Coloproctol., 24(8)*:787-802, 2020.

Perry, I. E.; Craig, E.; Cheema, A. & Yap, J. E. Gastrointestinal: Endoscopic suture removal resolves chest pain after esophagectomy. *J. Gastroenterol. Hepatol., 36(12)*:3257, 2021.

Qiu, Y., Zhang, T. J. & Hua, Z. Erector spinae plane block for lumbar spinal surgery: a systematic review. *J. Pain Res., 13*:1611-9, 2020.

Ruscio, L.; Renard, R.; Lebacle, C.; Zetlaoui, P.; Benhamou, D. & Bessede, T. Thoracic paravertebral block: comparison of different approaches and techniques. A study on 27 human cadavers. *Anaesth. Crit. Care Pain Med., 39(1)*:53-8, 2020.

Saadawi, M.; Layera, S.; Aliste, J.; Bravo, D.; Leurcharusmee, P. & Tran, Q. Erector spinae plane block: A narrative review with systematic analysis of the evidence pertaining to clinical indications and alternative truncal blocks. *J. Clin. Anesth., 68*:110063, 2021.

Sharma, P.; Shaheen, N. J.; Katzka, D. & Bergman, J. J. G. H. M. AGA clinical practice update on endoscopic treatment of Barrett's esophagus with dysplasia and/or early cancer: expert review. *Gastroenterology, 158(3)*:760-9, 2020.

Viderman, D.; Dautova, A. & Sarria-Santamera, A. Erector spinae plane block in acute interventional pain management: a systematic review. *Scand. J. Pain, 21(4)*:671-9, 2021.

Wang, A.; Peng, T.; Zhang, P. & Fan, K. Thoracic Paravertebral Block (TPVB) in non-intubated open reduction and internal rib fixation. *J. Clin. Anesth., 65*:109848, 2020.

Xiong, C.; Han, C.; Zhao, D.; Peng, W.; Xu, D. & Lan, Z. Postoperative analgesic effects of paravertebral block versus erector spinae plane block for thoracic and breast surgery: A meta-analysis. *PLoS One, 16(8)*:e0256611, 2021.

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